Project Manual

DUNN COUNTY PUBLIC SAFETY CENTER

Manning, North Dakota

JLG architects

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Project Number: JLG 24146.01

Date: October 21, 2025

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SECTION 00 0105 - CERTIFICATIONS PAGE

DUNN COUNTY PUBLIC SAFETY CENTER

MANNING, NORTH DAKOTA

Architect

I hereby certify that this Plan, Specification, or Report was prepared by me or under my direct supervision, and that I am a duly Registered Architect under the laws of the State of North Dakota.

Katelyn Crider, AIA **October 21, 2025**
Reg. No. 2867

Structural Engineer

I hereby certify that this Plan, Specification, or Report was prepared by me or under my direct supervision, and that I am a duly Registered Professional Engineer under the laws of the State of North Dakota.

Eric A. Greiff, PE **October 21, 2025**
Reg. No. PE-4983

Civil Engineer

I hereby certify that this Plan, Specification, or Report was prepared by me or under my direct supervision, and that I am a duly Registered Professional Engineer under the laws of the State of North Dakota.

REGISTERED PROFESSIONAL ENGINEER
ANDREW SCHRANK
PE-9814
DATE 10/21/25
NORTH DAKOTA

Digitally signed by Andrew Schrank
Date: 2025.10.20 15:44:06 -06'00'

Andrew Schrank, PE **October 21, 2025**
Reg. No. 9814

Mechanical Engineer

I hereby certify that this Plan, Specification, or Report was prepared by me or under my direct supervision, and that I am a duly Registered Professional Engineer under the laws of the State of North Dakota.

Caleb Bulow, PE **October 21, 2025**
Reg. No. 7110

Electrical Engineer

I hereby certify that this Plan, Specification, or Report was prepared by me or under my direct supervision, and that I am a duly Registered Professional Engineer under the laws of the State of North Dakota.

Jason L. Hunze, PE **October 21, 2025**
Reg. No. PE-4879

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SECTION 00 2600 - PROCUREMENT SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes

1. Requirements for submitting substitution requests for materials, products, equipment and methods of construction from those required by the Procurement Documents, during the procurement phase and prior to execution of the Owner/Contractor Agreement.

1.02 SUBSTITUTIONS (DURING THE PROCUREMENT/BIDDING PHASE)

A. The technical specification sections may have several materials, products, equipment and methods of construction specified under the same heading. Selection of a specified materials, products, equipment and methods of construction shall be at the option of the Bidder. Where materials, products, equipment and methods of construction are specified accompanied with the phrase "Or Equal", "Approved Substitution", or similar verbiage, the Bidder may submit materials, products, equipment and methods of construction for approval in accordance with the requirements of this Document.

B. No substitution will be considered prior to receipt of Bids unless written request for approval has been received by the Architect (or Construction Manager as applicable) at least seven working days prior to the date for receipt of Bids.

1. Submit each request for substitution on the Architect's "Procurement Substitution Request Form" included at the end of this Section.
2. Submit one material, product, equipment and methods of construction per request form, either duplicated from the Project Manual or available from the Architect's office.
3. Submittals not accompanied by this form properly filled in and endorsed, will be discarded without review. NO EXCEPTIONS.
4. Where specified materials, products, and equipment are accompanied by a color, pattern or finish selection, requests for substitution shall include an actual sample of the proposed color, pattern or finish for review.
5. Where multiple materials, products or equipment are specified within a single specification section, specifically identify which product you wish to substitute.

C. The burden of proof of the merit of the proposed substitution is upon the proposer. The Architect's decision of approval or rejection of a proposed substitution shall be final.

D. Materials, products, equipment and methods of construction approved by this substitution procedure will be issued in an Addendum.

E. Refer to Section 01 2500 for requests for substitutions after execution of the Owner/Contractor Agreement.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

PROCUREMENT SUBSTITUTION REQUEST FORM

TO: JLG Architects
402 E Main Avenue, Suite 1
Bismarck, ND 58501

Phone: 701-989-7719
Contact: Naomi Echternach
NEchternach@jlgarchitects.com

PROJECT: Dunn County Public Safety Center, Manning, North Dakota

Section Number_____ Section Title_____

Specified Product_____

Proposed Substitution_____

All of the following questions must be answered. Incomplete forms will be not be reviewed.

1. The following supporting data is attached:
   □ Drawings □ Product Data □ Samples □ Tests □ Reports
2. Does the proposed substitution affect dimensions shown on Drawings, or functional clearances?
   □ YES □ NO
3. Does the proposed substitution change the design or details shown on the Drawings?
   □ YES □ NO
4. Does the proposed substitution affect other trades?
   □ YES □ NO
5. Does the proposed substitution affect maintenance service, or source of replacement parts, if applicable?
   □ YES □ NO
6. Does the proposed guarantee or warranty differ from that specified?
   □ YES □ NO
7. If "YES" to Items 2, 3, 4, 5 or 6 above, attach a thorough explanation on your company letterhead.
8. If there are other major differences between proposed substitution and specified product, attach a thorough explanation on your company letterhead.
9. The proposed substitution was used within the last 24 months on the following project:
   Project Name_____
   Location_____
   Architect_____Telephone No._____
10. Has the proposed substitution been used on a JLG Architects project within the last 12 months?
    □ YES □ NO; If yes, which project?_____
11. The undersigned states that the function, appearance and quality of the substitution item are equivalent or superior to the specified item.

Submitted By: Firm_____ Signature_____
Address_____
Telephone_____Fax_____
Date_____ E-Mail_____

For Use By Design Consultant: □ Accepted □ Accepted As Noted □ Not Accepted □ Received Too Late

Name_____ Signature_____

Date_____ Remarks_____

SECTION 00 3100 - AVAILABLE PROJECT INFORMATION

PART 1 GENERAL

1.01 EXISTING CONDITIONS

A. Certain information relating to existing surface and subsurface conditions and structures is available to bidders but will not be part of Contract Documents, as follows:

B. Geotechnical Report: Entitled Proposed Dunn County Safety Center, dated September 9, 2025 and prepared by MTS.

1. Digital copy is available per request to JE Dunn.
2. This report identifies properties of below grade conditions and offers recommendations for the design of foundations, prepared primarily for the use of Architect/Structural Engineer.
3. This report, by its nature, cannot reveal all conditions that exist on the site. Should subsurface conditions be found to vary substantially from this report, changes in the design and construction of foundations will be made, with resulting credits or expenditures to the Contract Price accruing to Owner.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 2300 - ALTERNATES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Description of Alternates.

B. Procedures for pricing Alternates.

C. Documentation of changes to Contract Sum and Contract Time.

1.02 DEFINITIONS

A. Alternate: An alternate is an amount proposed by Bidders and stated on the Bid Form for certain construction activities defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if the Owner decides to accept a corresponding change in either the amount of construction to be completed, or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1.03 ACCEPTANCE OF ALTERNATES

A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted Alternates will be identified in the Owner-Contractor Agreement.

B. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.

C. Work Included Under Each Alternate: Make modifications to work required by each alternate selected at no additional cost to the Owner other than as proposed on the Bid Form. Bidders shall be responsible for alternates and shall see that all changes are covered under their related sections, whether specifically called out or not. Extra costs incurred due to modifications to or deviations from the Drawings or Specifications caused directly or indirectly by each alternate shall be included in each alternate bid.

1.04 SCHEDULE OF ALTERNATES

A. Alternate No. 1: Site Lighting.

1. State the amount to be ADDED the Base Bid to provide all materials, labor & equipment required for providing an additional (7) light poles around site, as indicated in the drawings and specifications.

B. Alternate No. 2: Radiant Floor Heating.

1. State the amount to be ADDED to or DEDUCTED from the Base Bid to provide all materials, labor & equipment required for providing radiant floor heating in lieu of radiant tube heaters, as indicated in the drawings and specifications.

C. Alternate No. 3: Electrical Yard Screen.

1. State the amount to be ADDED to the Base Bid to provide all materials, labor & equipment required for providing additional screening panels and structural framing, as indicated in the drawings and specifications.

D. Alternate No. 4: Formliner Finish.

1. State the amount to be ADDED to or DEDUCTED from the Base Bid to provide all materials, labor & equipment required for a formliner finish on exterior and select interior walls, as indicated in the drawings and specifications.

E. Alternate No. 5: Specific Site Scope.

1. State the amount to be ADDED to from the Base Bid to provide all materials, labor & equipment required for specific site scope delineated as Owner performed in base bid, (rough grading, subbase for parking lots, gravel placement, and scoria removal), as indicated in the drawings and specifications.

F. Alternate No. 6: Shooting Range Fit-Out.
   1. State the amount to be ADDED the Base Bid to provide all materials, labor & equipment required for Shooting Range Fit-Out, (including equipment scope and associated mechanical equipment), as indicated in the drawings and specifications.

G. Alternate No. 7: Landscape.
   1. State the amount to be ADDED the Base Bid to provide all materials, labor & equipment required for providing indicated plantings, (trees, shrubs and plants), along with drip irrigation, as indicated in the drawings and specifications.

H. Alternate No. 8: Exterior Accent Lighting.
   1. State the amount to be ADDED the Base Bid to provide all materials, labor & equipment required for the addition of custom lighting on the perimeter of the building, as indicated in the drawings and specifications.

I. Alternate No. 9: Buried Propane Tank.
   1. State the amount to be ADDED the Base Bid to provide all materials, labor & equipment required for the addition of a buried propane tank in lieu of above ground propane tank, as indicated in the drawings and specifications.

J. Alternate No. 10: Monument Sign.
   1. State the amount to be ADDED the Base Bid to provide all materials, labor & equipment required for the addition of a monument sign, as indicated in the drawings and specifications.

K. Alternate No. 11: Wall Protection.
   1. State the amount to be ADDED/DEDUCTED from the Base Bid to provide all materials, labor & equipment required for Rampart wall protection in lieu of Nevamar wall protection, as indicated in the drawings and specifications.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 2500 - SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedural requirements for proposed substitutions.

1.02 RELATED REQUIREMENTS

A. Section 00 2600 - Procurement Substitution Procedures: Required form for substitutions requests made before the end of bidding (during procurement).

B. Section 01 3000 - Administrative Requirements: Submittal procedures, coordination.

C. Section 01 6000 - Product Requirements: Fundamental product requirements, product options, delivery, storage, and handling.

1.03 REFERENCE STANDARDS

A. CSI/CSC Form 13.1A - Substitution Request (After the Bidding/Negotiating Phase); Current Edition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:

1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
2. Agrees to provide the same warranty for the substitution as for the specified product.
3. Agrees to provide same or equivalent maintenance service and source of replacement parts, as applicable.
4. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
5. Waives claims for additional costs or time extension that may subsequently become apparent.
6. Agrees to reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.

B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.

C. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.

1. Forms included in the Project Manual are adequate for this purpose, and must be used.

D. Limit each request to a single proposed substitution item.

1. Submit an electronic document, combining the request form with supporting data into single document.

3.02 SUBSTITUTION PROCEDURES DURING PROCUREMENT

A. Section 00 2600 - Procurement Substitution Procedures specifies time restrictions for submitting requests for substitutions during the bidding period, and the documents required.

3.03 SUBSTITUTION PROCEDURES DURING CONSTRUCTION

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

B. Architect will consider requests for substitutions only within 30 days after date of Agreement. Requests for substitutions after the bids have been received are done so at the risk of the Contractor. Substitutions may not be granted.

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

D. Substitutions will not be considered under one or more of the following circumstances:
   1. When they are indicated or implied on shop drawing or product data submittals, without having received prior approval.
   2. Without a separate written request.
   3. When acceptance will require revisions to Contract Documents.

3.04 RESOLUTION

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

B. Architect will notify Contractor in writing of decision to accept or reject request.

3.05 ACCEPTANCE

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

END OF SECTION

SECTION 01 3000 - ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General administrative requirements.
B. Submittals for review, information, and project closeout.
C. Number of copies of submittals.
D. Submittal procedures.

1.02 RELATED REQUIREMENTS

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

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 REQUESTS FOR INFORMATION (RFI)

A. Definition: A request seeking one of the following:
   1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in Contract Documents.
   2. A resolution to an issue which has arisen due to field conditions and affects design intent.
B. Whenever possible, request clarifications at the next appropriate project progress meeting, with response entered into meeting minutes, rendering unnecessary the issuance of a formal RFI.
C. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
   1. Prepare a separate RFI for each specific item.
      a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.
      b. Do not forward requests which solely require internal coordination between subcontractors.
   2. Prepare in a format and with content acceptable to Owner.
   3. Combine RFI and its attachments into a single electronic file. PDF format is preferred.
D. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.
   1. Include in each request Contractor's signature attesting to good faith effort to determine from Contract Documents information requiring interpretation.
   2. Unacceptable Uses for RFIs: Do not use RFIs to request the following::
      a. Approval of submittals (use procedures specified elsewhere in this section).
      b. Approval of substitutions (see Section - 01 6000 - Product Requirements)
      c. Changes that entail change in Contract Time and Contract Sum (comply with provisions of the Conditions of the Contract).

d. Different methods of performing work than those indicated in the Contract Drawings and Specifications (comply with provisions of the Conditions of the Contract).

3. Improper RFIs: Requests not prepared in compliance with requirements of this section, and/or missing key information required to render an actionable response. They will be returned without a response, with an explanatory notation.
4. Frivolous RFIs: Requests regarding information that is clearly indicated on, or reasonably inferable from, Contract Documents, with no additional input required to clarify the question. They will be returned without a response, with an explanatory notation.
   a. The Owner reserves the right to assess the Contractor for the costs (on time-and-materials basis) incurred by the Architect, and any of its consultants, due to processing of such RFIs.

E. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.
1. Official Project name and number, and any additional required identifiers established in Contract Documents.
2. Owner's, Architect's, and Contractor's names.
3. Discrete and consecutive RFI number, and descriptive subject/title.
4. Issue date, and requested reply date.
5. Reference to particular Contract Document(s) requiring additional information/interpretation. Identify pertinent drawing and detail number and/or specification section number, title, and paragraph(s).
6. Annotations: Field dimensions and/or description of conditions which have engendered the request.
7. Contractor's suggested resolution: A written and/or a graphic solution, to scale, is required in cases where clarification of coordination issues is involved, for example; routing, clearances, and/or specific locations of work shown diagrammatically in Contract Documents. If applicable, state the likely impact of the suggested resolution on Contract Time or the Contract Sum.

F. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.

G. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.
1. Indicate current status of every RFI. Update log promptly and on a regular basis.
2. Note dates of when each request is made, and when a response is received.
3. Highlight items requiring priority or expedited response.
4. Highlight items for which a timely response has not been received to date.
5. Identify and include improper or frivolous RFIs.

H. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner.
1. Do not extend applicability of a response to specific item to encompass other similar conditions, unless specifically so noted in the response.
2. Upon receipt of a response, promptly review and distribute it to all affected parties, and update the RFI Log.

3.02 SUBMITTAL SCHEDULE

A. Submit to Architect for review a schedule for submittals in tabular format.
1. Coordinate with Contractor's construction schedule and schedule of values.

2. Format schedule to allow tracking of status of submittals throughout duration of construction.
3. Arrange information to include scheduled date for initial submittal, specification number and title, submittal category (for review or for information), description of item of work covered, and role and name of subcontractor.
4. Account for time required for preparation, review, manufacturing, fabrication and delivery when establishing submittal delivery and review deadline dates.
    a. For assemblies, equipment, systems comprised of multiple components and/or requiring detailed coordination with other work, allow for additional time to make corrections or revisions to initial submittals, and time for their review.

3.03 SUBMITTALS FOR REVIEW

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

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

3.05 SUBMITTALS FOR PROJECT CLOSEOUT

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

3.06 NUMBER OF COPIES OF SUBMITTALS

A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.

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

3.07 SUBMITTAL PROCEDURES

A. General Requirements:
   1. Use a separate transmittal for each item.
   2. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
   3. 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.
      a. Submittals from sources other than the Contractor, or without Contractor's stamp will not be acknowledged, reviewed, or returned.
   4. Deliver each submittal on date noted in submittal schedule, unless an earlier date has been agreed to by all affected parties, and is of the benefit to the project.
   5. Schedule submittals to expedite the Project, and coordinate submission of related items.
      a. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.
      b. For sequential reviews involving Architect's consultants, Owner, or another affected party, allow an additional 7 days.
      c. Color selections will not be reviewed or approved until all related products are submitted to ensure a cohesive palette.
      d. Products that make up a system, assembly, or that are directly related to each other often must be reviewed together. Review will not begin until all components are submitted.
      e. Coordinate with Architect and/or Construction Manager, as applicable, where schedule dictates an expedited review of products.
   6. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
   7. Provide space for Contractor and Architect review stamps.
   8. When revised for resubmission, identify all changes made since previous submission.
   9. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.
   10. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.

B. Product Data Procedures:
   1. Submit only information required by individual specification sections.
   2. Collect required information into a single submittal.
   3. Do not submit (Material) Safety Data Sheets for materials or products.

C. Shop Drawing Procedures:

1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
2. Do not reproduce Contract Documents to create shop drawings.
3. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.

D. Samples Procedures:
1. Transmit related items together as single package.
2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.

E. Do not use shop drawings without an appropriate final stamp indicating action taken in connection with construction.

3.08 SUBMITTAL REVIEW

A. Submittals for Review: Architect will review each submittal, and approve, or take other appropriate action.

B. Submittals for Information: Architect will acknowledge receipt and review.

C. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.

END OF SECTION

SECTION 01 4000 - QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

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

1.02 RELATED REQUIREMENTS

A. Section 01 3000 - Administrative Requirements: Submittal procedures.
B. Section 01 4533 - Code-Required Special Inspections and Procedures.
C. Section 01 6000 - Product Requirements: Requirements for material and product quality.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
C. Test Reports: After each test/inspection, promptly submit two 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. Compliance 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 compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
D. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.

1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.

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

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

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

1.04 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. Comply with 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 Contract Documents by mention or inference otherwise in any reference document.

1.05 TESTING AND INSPECTION AGENCIES AND SERVICES

A. Owner will employ and pay for services of an independent testing agency to perform other 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. See individual specification sections for testing and inspection required.

B. Testing Agency Duties:

1. Test samples of mixes submitted by Contractor.
2. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
3. Perform specified sampling and testing of products in accordance with specified standards.
4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
5. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
6. Perform additional tests and inspections required by Architect.
7. Attend preconstruction meetings and progress meetings.
8. Submit reports of all tests/inspections specified.
9. Submit a written report in binder form with an index at the conclusion of the work required by the Testing Agency. The report shall be submitted as a permanent record to the Owner, through the Structural Engineer, of all tests, logs, comments and written reports.

C. Limits on Testing/Inspection Agency Authority:

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

D. Contractor Responsibilities:

1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
3. Provide incidental labor and facilities:
    a. To provide access to Work to be tested/inspected.
    b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
    c. To facilitate tests/inspections.

d. To provide delivery of samples to testing laboratories.
e. 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. Each Prime Contractor is responsible for scheduling times for inspections, tests, taking samples, and similar activities.
6. Each Prime Contractor and each agency engaged to perform inspections, tests, and similar services shall coordinate the sequence of activities to accommodate required services with minimal delay.
7. Each Prime Contractor and each agency shall coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.
8. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
9. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

E. Re-testing: The Contractor is responsible for re-testing where results of required inspections, tests, or similar services prove unsatisfactory or do not indicate compliance with Contract Document requirements, regardless of whether the original test was the Contractor's responsibility.

F. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.

G. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

H. The Contractor shall cooperate with agencies performing required inspections, tests, and similar services and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel.

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 equipment as applicable, and to initiate instructions when necessary.

B. Submit qualifications of observer to Architect 30 days in advance of required observations.
1. Observer subject to approval of Architect.
2. Observer subject to approval of Owner.

C. 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 complying with 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 4533 - CODE-REQUIRED SPECIAL INSPECTIONS AND PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Code-required special inspections.
B. Testing services incidental to special inspections.
C. Submittals.
D. Manufacturers' field services.
E. Fabricators' field services.

1.02 DEFINITIONS

A. Code or Building Code: ICC (IBC), International Building Code, most recent edition adopted by authority having jurisdiction, including all applicable amendments and supplements without limitation, and specifically Chapter 17 - Special Inspections and Tests.
B. Authority Having Jurisdiction (AHJ): Agency or individual officially empowered to enforce the building, fire and life safety code requirements of the permitting jurisdiction in which the Project is located.
C. Special Inspections and Tests: Inspections and testing of materials, installation, fabrication, erection, or placement of components and connections mandated by Building Code to safeguard public welfare.
    1. Special inspections and tests are separate from and independent of tests and inspections conducted by Owner or Contractor for purposes of quality assurance and contract administration.

1.03 REFERENCE STANDARDS

A. IAS AC89 - Accreditation Criteria for Testing Laboratories; 2021.
B. IAS AC291 - Accreditation Criteria for Special Inspection Agencies AC291; 2023.
C. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Special Inspection Agency Qualifications: Prior to start of work, Special Inspection Agency is required to:
    1. Submit agency name, address, and telephone number, names of full time registered Engineer and responsible officer.
    2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
    3. Submit certification that Special Inspection Agency is acceptable to AHJ.
    4. Submit documentation that Special Inspection Agency is accredited by IAS according to IAS AC291.
C. Testing Agency Qualifications: Prior to start of work, Testing Agency is required to:
    1. Submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
    2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
    3. Submit certification that Testing Agency is acceptable to AHJ.

4. Submit documentation that Testing Agency is accredited by IAS according to IAS AC89.

D. Special Inspection Reports: After each special inspection, Special Inspector is required to submit at least two copies of report; one to Architect and one to AHJ.
   1. Include:
      a. Date issued.
      b. Project title and number.
      c. Name of Special Inspector.
      d. Date and time of special inspection.
      e. Identification of product and specifications section.
      f. Location in the Project.
      g. Type of special inspection.
      h. Date of special inspection.
      i. Results of special inspection.
      j. Compliance with contract documents.
   2. Final Special Inspection Report: Document special inspections and correction of discrepancies prior to the start of the work.

E. Test Reports: After each test or inspection, Testing Agency is required to submit report to Architect and to AHJ.
   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 or inspection.
      h. Date of test or inspection.
      i. Results of test or inspection.
      j. Compliance with contract documents.

F. Certificates: When required by AHJ, Special Inspector will submit certification by manufacturer, fabricator, and installation subcontractor to Architect and AHJ.
   1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
   2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect and AHJ.

G. Fabricator's Inspection Reports: When required by AHJ, submit reports to Architect and AHJ.
   1. Submit report in duplicate within 30 days of observation to Architect for information.

1.05 SPECIAL INSPECTION AND TESTING AGENCY

A. Owner will employ services of a Special Inspection Agency to perform inspections and associated testing and sampling in accordance with ASTM E329 and required by the building code.

B. Employment of agency in no way relieves Contractor of obligation to perform work in accordance with requirements of contract documents.

1.06 TESTING AND INSPECTION AGENCIES

A. Owner may employ services of an independent testing agency to perform additional testing and sampling associated with special inspections but not required by the building code.

B. Employment of agency in no way relieves Contractor of obligation to perform work in accordance with requirements of contract documents.

1.07 QUALITY ASSURANCE

A. Special Inspection Agency Qualifications:

1. Independent firm specializing in performing testing and inspections of the type specified in this section.

B. Testing Agency Qualifications:

1. Independent firm specializing in performing testing and inspections of the type specified in this section.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 SCHEDULE OF SPECIAL INSPECTIONS, GENERAL

A. Frequency of Special Inspections: Special Inspections are indicated as continuous or periodic.

1. Continuous Special Inspection: Special Inspection Agency is required to be present in the area where the work is being performed and observe the work at all times the work is in progress.
2. Periodic Special Inspection: Special Inspection Agency is required to be present in the area where work is being performed and observe the work part-time or intermittently and at the completion of the work.

3.02 SPECIAL INSPECTIONS FOR STEEL CONSTRUCTION

A. Structural Steel: Comply with quality assurance inspection requirements of ICC (IBC)-2018.

B. Cold-Formed Steel Deck: Comply with quality assurance inspection requirements of SDI (QA/QC).

3.03 SPECIAL INSPECTIONS FOR CONCRETE CONSTRUCTION

A. Reinforcement, Including Prestressing Tendons, and Verification of Placement: Verify compliance with ACI CODE-318, Chapters 20, 25.2, 25.3, 26.6.1-26.6.3; periodic.

B. Bolts Installed in Concrete: Where allowable loads have been increased or where strength design is used, verify compliance with approved Contract Documents and ACI CODE-318, Sections 8.1.3 and 21.2.8 prior to and during placement of concrete; continuous.

C. Anchors Post-Installed in Hardened Concrete: Verify compliance with ACI CODE-318.

1. Adhesive Anchors: Verify horizontally or upwardly-inclined orientation installations resisting sustained tension loads - Section 17.8.2.4; continuous.
2. Other Mechanical and Adhesive Anchors: Verify as per Chapter 17.8.2; periodic.

D. Design Mix: Verify plastic concrete complies with the design mix in approved Contract Documents and with ACI CODE-318, Chapter 19, 16.4.3, 26.4.4; periodic.

E. Concrete Sampling Concurrent with Strength Test Sampling: Each time fresh concrete is sampled for strength tests, verify compliance with ASTM C172/C172M, ASTM C31/C31M, and ACI CODE-318, Chapter 26.5, 26.12, and record the following, continuous:

1. Slump.
2. Air content.

3. Temperature of concrete.

F. Specified Curing Temperature and Techniques: Verify compliance with ACI CODE-318, Chapter 26.5.3 through 26.5.5; periodic.

G. Materials: If the Contractor cannot provide sufficient data or documentary evidence that concrete materials comply with the quality standards of ACI CODE-318, the AHJ will require testing of materials in accordance with the appropriate standards and criteria in ACI CODE-318, Chapters 19 and 20.

3.04 SPECIAL INSPECTIONS FOR SOILS

A. Materials and Placement: Verify each item below complies with approved construction documents and approved geotechnical report.
   1. Design bearing capacity of material below shallow foundations; periodic.
   2. Design depth of excavations and suitability of material at bottom of excavations; periodic.
   3. Materials, densities, lift thicknesses; placement and compaction of backfill: continuous.
   4. Subgrade, prior to placement of compacted fill verify proper preparation; periodic.

B. Testing: Classify and test excavated material; periodic.

3.05 SPECIAL INSPECTION AGENCY DUTIES AND RESPONSIBILITIES

A. Special Inspection Agency shall:
   1. Verify samples submitted by Contractor comply with the referenced standards and the approved Contract Documents.
   2. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
   3. Perform specified sampling and testing of products in accordance with specified reference standards.
   4. Ascertain compliance of materials and products with requirements of Contract Documents.
   5. Promptly notify Architect and Contractor of observed irregularities or non-compliance of work or products.
   6. Perform additional tests and inspections required by Architect.
   7. Attend preconstruction meetings and progress meetings.
   8. Submit reports of all tests or inspections specified.

B. Limits on Special 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. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.

D. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

3.06 TESTING AGENCY DUTIES AND RESPONSIBILITIES

A. Testing Agency Duties:
   1. Test samples submitted by Contractor.
   2. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
   3. Perform specified sampling and testing of products in accordance with specified standards.

4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
5. Promptly notify Architect and Contractor of observed irregularities or non-compliance of work or products.
6. Perform additional tests and inspections required by Architect.
7. Attend preconstruction meetings and progress meetings.
8. Submit reports of all tests or inspections specified.

B. Limits on Testing or 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. On instructions by Architect, perform re-testing required because of non-compliance with specified requirements, using the same agency.

D. Contractor will pay for re-testing required because of non-compliance with specified requirements.

3.07 CONTRACTOR DUTIES AND RESPONSIBILITIES

A. Contractor Responsibilities, General:
1. Deliver to agency at designated location, adequate samples of materials for special inspections that require material verification.
2. Cooperate with agency and laboratory personnel; provide access to approved documents at project site, to the work, to manufacturers' facilities, and to fabricators' facilities.
3. Provide incidental labor and facilities:
a. To provide access to work to be tested or inspected.
b. To obtain and handle samples at the site or at source of Products to be tested or inspected.
c. To facilitate tests or 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 or inspection services.
5. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

3.08 FABRICATORS' FIELD SERVICES

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

B. Submit qualifications of observer to Architect 30 days in advance of required observations.
1. Observer subject to approval of Architect.
2. Observer subject to approval of Owner.

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

END OF SECTION

SECTION 01 5713 – TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Prevention of erosion due to construction activities.
   2. Prevention of sedimentation of waterways, open drainage ways, and storm and sanitary sewers due to construction activities.
   3. Restoration of areas eroded due to insufficient preventive measures.
   4. Compensation of Owner for fines levied by authorities having jurisdiction due to non-compliance by Contractor.

B. Reference Standards: (The current standard as of the date noted on the plans shall be utilized, unless noted otherwise)
   1. ASTM D792 - Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
   2. ASTM D1388 - Standard Test Method for Stiffness of Fabrics.
   3. ASTM D4355/D4355M - Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture, and Heat in a Xenon Arc-Type Apparatus.
   4. ASTM D4533/D4533M - Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
   5. ASTM D4595 - Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method.
   6. ASTM D4632/D4632M - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
   7. ASTM D4873/D4873M - Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples.
   8. ASTM D6460 - Standard Test Method for Determination of Rolled Erosion Control Product (RECP) Performance in Protecting Earthen Channels from Stormwater-Induced Erosion.
   9. ASTM D6524 - Standard Test Method for Measuring the Resiliency of Turf Reinforcement Mats (TRMs).
   10. ASTM D6525/D6525M - Standard Test Method for Measuring Nominal Thickness of Rolled Erosion Control Products.
   11. ASTM D6566 - Standard Test Method for Measuring Mass per Unit Area of Turf Reinforcement Mats.
   12. ASTM D6567 - Standard Test Method for Measuring the Light Penetration of a Turf Reinforcement Mat (TRM).
   13. ASTM D6575 - Standard Test Method for Determining Stiffness of Geosynthetics Used as Turf Reinforcement Mats (TRMs).
   14. ASTM D6818 - Standard Test Method for Ultimate Tensile Properties of Rolled Erosion Control Products.
   15. ASTM D7322 - Standard Test Method for Determination of Rolled Erosion Control Product (RECP) Ability to Encourage Seed Germination and Plant Growth Under Bench-Scale Conditions.
   16. EPA (NPDES) - National Pollutant Discharge Elimination System (NPDES), Construction General Permit.
   17. FHWA FLP-94-005 - Best Management Practices for Erosion and Sediment Control.

1.02 SUBMITTALS

A. Provide Manufacturer's data for erosion control materials indicating product specifications. Certify that products supplied meet or exceed specified requirements.

B. Storm Water Pollution Prevention Plan (SWPPP) meeting NDDEQ requirements:
   1. Submit not less than 30 days prior to anticipated start of clearing, grading, or other work involving disturbance of ground surface cover.
   2. Obtain the approval of the Plan by authorities having jurisdiction.
   3. Obtain the approval of the Plan by Owner.

C. Inspection Reports: Submit report of each inspection required by the SWPPP. Identify each preventive measure, indicate condition, and specify maintenance or repair required and accomplished.

PART 2 PRODUCTS

2.01 GRASS SEED FOR TEMPORARY COVER

A. Select a species appropriate to climate, planting season, and intended purpose. If same area will later be planted with permanent vegetation, do not use species known to be excessively competitive or prone to volunteer in subsequent seasons.

2.02 SILT FENCE WITH WIRE BACKING

A. Silt fence fabric shall conform to ASTM D4439.

B. Filter fabric shall be composed of fibers consisting of long chain synthetic polymers composed of at least 95% by weight of polyolefins, polyesters, or polyomides. The fibers shall be formed into a network such that the filaments or yarns retain dimensional stability relative to each other. The filter fabric shall be free of any treatment or coating which might adversely alter its physical properties after installation. The fabric shall be free of defects or flaws that affect its physical and/or filtering properties. The fabric shall have a minimum width of 36 inches. The filter fabric shall be furnished with suitable wrapping for protection against moisture and extended ultraviolet exposure prior to placement.

C. Backing for a filter fabric silt fence shall consist of steel wire fence fabric. A woven wire fence shall conform to ASTM A116 Class 1 zinc coating for wire. The woven wire support fence shall be at least 32-inches high with a maximum opening size of 6-inches by 6-inches. The wire shall be a minimum of 14-gauge grade 60.

D. Either wood or steel posts shall be used.
   1. Wood posts shall be treated (penta or green treated) and shall be a minimum of five feet long with minimum dimensions of 2 inches in diameter for round posts or 1½ by 1½ inches for rectangular posts
   2. Steel posts shall be a minimum of 5 feet long, weigh a minimum of 1.3 pounds per square foot, and have projections to aid in fastening the wire or fabric. Steel posts shall also have a metal plate welded near the bottom such that when the post is driven to the proper depth, the plate will be below the ground level for added stability.

2.03 STRAW WATTLES

A. Wattles shall consist of rice or wheat straw fibers as filler within a containment netting. Filler shall be certified as weed-free. Fibers must have an average length greater than 3 inches and shall contain

ultraviolet inhibiters. The strand thickness shall be no less than 0.035 inches, the knot thickness no less than 0.0555 inches, and the netting weight no less than 0.35 ounces per foot.

B. The entire wattle unit shall be sufficiently durable to withstand weather, construction, and installation conditions for at least three months, including multiple movements and reinstallations.

C. Wattles shall have a 12-inch diameter (1-inch tolerance) with a life expectancy of 6-to-24-months.

D. Wood posts of sufficient strength to withstand installation and weather shall be used for anchoring. Stakes shall be wooden, 1⅛ inches thick by 30 inches long.

2.04 WEIGHTED FIBER ROLLS

A. Weighted fiber roll shall be a photodegradable, extruded netting tube filled with wood curled excelsior and a weighted inner core. The weight shall be a minimum of 8⅓ pounds per foot.

B. The roll diameter shall be 6-inches and the lengths shall be as required.

C. An adequate number of weighted fiber rolls shall be placed around an inlet to provide complete protection.

2.05 DRAINAGE STRUCTURE INLET FILTER

A. Drainage structure inlet filters shall be as shown by the Plans and shall be installed immediately after installation of the storm inlet.

B. The inlet filters shall include an overflow feature designed to allow full flow of water into the structure if the filter is filled with sediment.

C. Inlet filters shall have a minimum flow rate of 130 gallons per minute per square foot.

D. Inlet filters shall remain in-place until final stabilization of site soils.

2.06 EROSION CONTROL BLANKET

A. Shall meet the requirements of NDDOT Standard Specification Section 856 for the type of blanket specified by the Plans.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine site and identify existing features that contribute to erosion resistance; maintain such existing features to greatest extent possible.

3.02 PREPARATION

A. Prepare Storm Water Pollution Prevention Plan (SWPPP) meeting current NDDEQ requirements. Submit the plan to the Architect for approval no less than 30 days prior to anticipated start of clearing, grading, or other work involving disturbance of ground surface cover.

B. Upon completion and approval of the SWPPP and a minimum of seven (7) days prior to starting any construction activity on-site, submit a "Notice of Intent to Obtain Coverage under NDPDES General Permit for Stormwater Discharges Associated with Construction Activity" (SFN 19145) to the North

Dakota Department of Environmental Quality (NDDEQ). Obtain Owner's approval and signature for this notice of intent. The provisions of the permit shall be followed by the contractor and any subcontractors on-site, and the SWPPP plan shall be updated by the contractor with any necessary changes throughout the duration of construction. Actual erosion and sediment control items required may vary from the plan shown herein due to the contractor's method of operations. Contractor shall provide necessary erosion and sediment control items and methods to comply with the NDPDES permit at all times until the "Notice of Termination to Cancel Coverage under NDPDES General Permit for Storm Water Discharges Associated with Construction Activity" (SFN 19146) is submitted by the contractor to the NDDEQ. The Notice of Termination shall not be submitted until final stabilization as defined within the NDPDES permit has been achieved.

C. Schedule work so that soil surfaces are left exposed for the minimum amount of time necessary to complete the work.

3.03 SCOPE OF PREVENTIVE MEASURES

A. In all cases, if permanent erosion resistant measures have been installed, temporary preventive measures are not required.

B. If temporary erosion control measures need to be removed to accommodate construction operations, the measures must be replaced by the end of the workday or prior to a rain event, whichever occurs sooner.

C. Construction Entrances: Traffic-bearing aggregate surface.
   1. Provide at each construction entrance from public right-of-way or where equipment will enter on-site paved areas.
   2. Where necessary to prevent tracking of mud onto right-of-way, provide wheel washing area out of direct traffic lane, with drain into sediment trap or basin.

D. Linear Sediment Barriers: Made of silt fences or fiber rolls.
   1. Provide linear sediment barriers:
      a. Along downhill perimeter edge of disturbed areas, including soil stockpiles.
      b. Along the toe of cut slopes and fill slopes.
   2. Space sediment barriers with the following maximum slope length upslope from barrier:
      a. Slope of Less Than 2 Percent: 100 feet.
      a. Slope Between 2 and 5 Percent: 75 feet.
      b. Slope Between 5 and 10 Percent: 50 feet.
      c. Slope Between 10 and 20 Percent: 25 feet.
      d. Slope Over 20 Percent: 15 feet.

E. Inlet Protection: Provide for all inlets that may collect sediment from disturbed areas.

F. Soil Stockpiles: Protect using perimeter straw wattles or silt fence.

G. Temporary Seeding: Place immediately in areas with no construction activity where permanent stabilization cannot be installed, or where no construction activity is planned for more than 14 days or 7 days for slopes 3:1 or greater.

H. All waste materials (including garbage, debris, cleaning wastes, wastewater, toxic materials, or hazardous materials) shall be properly disposed of off-site and not allowed to be carried by runoff or wind. The site shall be watered if necessary to prevent dust from blowing onto adjacent properties.

I. At the end of each workday any material placed on a public or private road shall be removed (not by flushing) to prevent sediment tracking.

J. The construction contractor shall be required to control oil and fuel spills, and the discharge of any chemicals to prevent such spills or discharges from entering any water course, sump, sewer system, water body, or wetland.

K. Any onsite concrete cleanout and wash areas must not impact public property. A concrete washout area shall be designated on-site by the contractor and included in the contractor's SWPPP. The concrete washout area shall be located away from surface waters and areas where water will drain.

3.04 INSTALLATION

A. Construction Entrance
   1. Width: As required; 20 feet, minimum.
   2. Length: 50 feet, minimum.
   3. Excavate minimum of 6-inches.
   4. Place geotextile fabric full width and length, with minimum 12-inch overlap at joints.
   5. Place and compact at least 6-inches of 2-to-4-inch diameter washed stone.

B. Silt Fence with Wire Backing
   1. Store and handle fabric in accordance with ASTM D4873/D4873M.
   2. Silt fence shall either be installed in a 4-inch deep by 6-inch-wide trench on the upslope side of the fence, or be machine sliced in with a 4-inch fabric embedment. If utilizing trench method, trench shall be backfilled and compacted. Top of fabric shall be at a minimum 32-inch nominal height.
   3. Steel posts shall be installed at a maximum 4-foot spacing. Wood posts shall be installed at a maximum of 4-foot spacing. All posts shall be installed with a minimum embedment of 24-inches.
   4. Do not splice fabric along its width and minimize splices in fabric along its length. Splice at posts only with a minimum overlap length of 18-inches and place an extra post at splices.

C. Fiber Rolls
   1. Install with a minimum overlap of 1 foot at ends of rolls.
   2. Embed the bottom of the wattle at least 3 inches in the ground. Place soil excavated for trench against bales on the upslope side of the row and compact.
   3. Install stakes at least every 4 feet. Stakes shall not extend more than two inches above straw wattle.

D. Weighted Fiber Roll

   1. Provide fiber rolls meeting the following requirements:
      a. Non-degradable, extruded netting tube filled with wood curled excelsior and weighted inner core
      b. 8-inch roll diameter
      c. 6-foot roll length
      d. 8.33 lb/ft roll weigh

   2. Approximately 3 to 6 inches shall be left between the weighted fiber rolls and the inlets they are protecting. The fiber roll ends shall overlap 12 inches.

   3. When silt reaches one-third the height of the roll, remove and dispose of the silt and debris to allow the device to function properly.

E. Erosion Control Blanket

1. All rocks or clods over 1½ inches in diameter and all sticks and other foreign material shall be removed prior to placement of blankets. Seed the disturbed area prior to placing blankets.

2. Blankets shall be rolled out in the direction of the flow. Blanket ends shall be overlapped by a minimum of one foot where additional rolls are needed. When implementing multiple blankets, upstream/upslope blankets shall overlap downstream/downslope blankets.

3. Wire staples and metal pins shall be driven flush to the soil surface.

4. Allow erosion control blankets to degrade naturally, unless otherwise specified.

F. Drainage Structure Inlet Filter

1. Install according to the manufacturer's recommendations.

3.05 MAINTENANCE

A. Inspect preventive measures weekly, within 24 hours after the end of any storm that produces 0.25 inches or more rainfall at the project site, and daily during prolonged rainfall.

B. Repair deficiencies immediately or as soon as conditions allow.

C. Silt Fences:
1. Promptly replace fabric that deteriorates unless the need for fence has passed.
2. Remove silt deposits that exceed one-third of the height of the fence.
3. Repair fences that are undercut by runoff or otherwise damaged, whether by runoff or other causes.

D. Fiber Rolls:
1. Promptly replace rolls that fall apart or otherwise deteriorate unless need has passed.
2. Remove silt deposits that exceed one-half of the height of the rolls.
3. Repair rows that are undercut by runoff or otherwise damaged, whether by runoff or other causes.

E. Clean out temporary sediment control structures once sediment accumulation reaches a depth of 2-feet maximum and relocate soil on site.

F. Place sediment in appropriate locations on site; do not remove from site.

G. When Architect, Owner, or Owner's Representative notifies the Contractor that the erosion control measures (BMP's) are not in compliance with the SWPPP, the Contractor shall have 4 hours to begin addressing the situation and shall work diligently to resolve the issue as quickly as reasonably possible. Architect or Owner may apply a contract price reduction of $1,000 per day until the issue is resolved.

H. Contractor is responsible for payment of any fines, fees, or other financial penalties imposed by any governmental agency for Contractor's failure to comply with the terms of the SWPPP.

3.06 CLEAN UP

A. Remove temporary measures after permanent measures have been installed, unless permitted to remain by Owner.

B. Clean out temporary sediment control structures that are to remain as permanent measures.

C. Where removal of temporary measures would leave exposed soil, shape surface to an acceptable grade and finish to match adjacent ground surfaces.

D. Comply with all SWPPP and NDDEQ Permit requirements relative to protection removal.

END OF SECTION

SECTION 01 5813 - TEMPORARY PROJECT SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project identification sign.

1.02 QUALITY ASSURANCE

A. Design sign and structure to withstand 50 miles/hr (80 km/hr) wind velocity.

B. Finishes, Painting: Adequate to withstand weathering, fading, and chipping for duration of construction.

PART 2 PRODUCTS

2.01 SIGN MATERIALS

A. Structure and Framing: New, wood, structurally adequate.

B. Sign Surfaces: Exterior grade plywood with medium density overlay, minimum 3/4 inch (19 mm) thick, standard large sizes to minimize joints.

C. Sign Media: Sintra PVC foam board or approved equal product.

2.02 PROJECT IDENTIFICATION SIGN

A. One printed sign of construction, design, and content shown on Drawings, location designated.

B. Size: 8 feet high by 12 feet wide.

C. Graphics for the sign will be provided in electronic format by the Architect. Contractor shall have the graphic printed on the specified sign media.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install project identification sign within 30 days after date fixed by Notice to Proceed.

B. Erect at location coordinated with Architect.

C. Erect supports and framing on secure foundation, rigidly braced and framed to resist wind loadings.

D. Install sign surface plumb and level, with butt joints. Anchor securely.

E. Paint exposed surfaces of sign, supports, and framing.

3.02 MAINTENANCE

A. Maintain signs and supports clean, repair deterioration and damage.

3.03 REMOVAL

A. Remove signs, framing, supports, and foundations at completion of Project and restore the area.

END OF SECTION

SECTION 01 6000 - PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General product requirements.
B. Re-use of existing products.
C. Transportation, handling, storage and protection.
D. Product option requirements.
E. Substitution limitations.
F. Procedures for Owner-supplied products.
G. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

A. Section 00 2600 - Procurement Substitution Requirements: Requests for substitution during the bidding process.
B. Section 01 2500 - Substitution Procedures: Substitutions made during procurement and/or construction phases.
C. Section 01 4000 - Quality Requirements: Product quality monitoring.
D. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions: Requirements for VOC-restricted product categories.
E. Section 01 7419 - Construction Waste Management and Disposal: Waste disposal requirements potentially affecting product selection, packaging and substitutions.

1.03 DEFINITIONS

A. Definitions used in this Article are not intended to change the meaning of other terms used in the Contract Documents, such as "specialties," "systems," "structure," "finishes," "accessories," and similar terms. Such terms are self-explanatory and have well recognized meanings in the construction industry.
    1. "Products" are items purchased for incorporation in the Work, whether purchased for the Project or taken from previously purchased stock. The term "product" includes the terms "material," " equipment," "system," and terms of similar intent.
    2. "Named Products" are items identified by manufacturer's product name, including make or model designation, indicated in the manufacturer's published product literature, that is current as of the date of the Contract Documents.
    3. "Materials" are products that are substantially shaped, cut, worked, mixed, finished, refined, or otherwise fabricated, processed, or installed to form a part of the Work.
    4. "Equipment" is a product with operational parts, whether motorized or manually operated, that requires service connections such as wiring or piping.

1.04 SUBMITTALS

A. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
    1. Submit within 30 days after date of Agreement.
    2. For products specified only by reference standards, list applicable reference standards.

B. 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.

C. 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.

D. 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.

E. Sustainable Design Submittals: Items necessary to document use of sustainable construction materials, products, and practices.

1.05 QUALITY ASSURANCE

A. Source Limitations: To the fullest extent possible, provide products of the same kind, from a single source.

B. Compatibility of Options: When the Contractor is given the option of selecting between two or more products for use on the Project, the product selected shall be compatible with products previously selected, even if previously selected products were also options.

1. Each prime Contractor is responsible for providing products and construction methods that are compatible with products and construction methods of other prime or separate Contractors.
2. If a dispute arises between prime Contractors over concurrently selectable, but incompatible products, the Architect will determine which products shall be retained and which are incompatible and must be replaced.

C. Nameplates: Except for required labels and operating data, do not attach or imprint manufacturer's or producer's nameplates or trademarks on exposed surfaces of products which will be exposed to view in occupied spaces or on the exterior.

D. Labels: Locate required product labels and stamps on a concealed surface or, where required for observation after installation, on an accessible surface that is not conspicuous.

E. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on an easily accessible surface which is inconspicuous in occupied spaces. The nameplate shall contain the following information and other essential operating data:

1. Name of product and manufacturer.
2. Model and serial number.
3. Capacity.
4. Speed.
5. Ratings.

F. Environmental Product Declaration (EPD): Publicly available, critically reviewed life cycle analysis having at least a cradle-to-gate scope.

1. Good: Product-specific; compliant with ISO 14044.
2. Better: Industry-wide, generic; compliant with ISO 21930, or with ISO 14044, ISO 14040, ISO 14025, and EN 15804; Type III third-party certification with external verification, in which the manufacturer is recognized as the program operator.

3. Best: Commercial-product-specific; compliant with ISO 21930, or with ISO 14044, ISO 14040, ISO 14025, and EN 15804; Type III third-party certification with external verification, in which the manufacturer is recognized as the program operator.
4. Where demonstration of impact reduction below industry average is required, submit both industry-wide and commercial-product-specific declarations; or submit at least 5 declarations for products of the same type by other manufacturers in the same industry.

G. Health Product Declarations (HPD): Complete, published declaration with full disclosure of known hazards, prepared using one of the HPDC (HPD-OLT) online tools.

H. Sustainably Harvested Wood: Solid wood, wood chips, and wood fiber sourced and labeled by an organization accredited by one of the following:
1. Wood sourced from a sustainable harvested location. Submit any documentation available.
2. Chain of Custody documents are not required.

PART 2 PRODUCTS

2.01 PRODUCT SELECTION

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, unused at the time of installation.
1. Provide products complete with all accessories, trim, finish, safety guards, and other devices and details needed for a complete installation and for the intended use and effect.
2. Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.

B. Product Selection Procedures: Product selection is governed by the Contract Documents and governing regulations, not by previous Project experience. Procedures governing product selection include the following:
1. Proprietary Specification Requirements: Where only a single product or manufacturer is named, provide the product indicated. No substitutions will be permitted.
2. Semi proprietary Specification Requirements: Where two or more products or manufacturers are named, provide one of the products indicated. No substitutions will be permitted.
a. Where products or manufacturers are specified by name, accompanied by the term "or equal," or "or approved equal" comply with the Contract Documents provisions concerning "substitutions" to obtain approval for use of an unnamed product.
3. Descriptive Specification Requirements: Where specifications describe a product or assembly, listing exact characteristics required, with or without use of a brand or trade name, provide a product or assembly that provides the characteristics and otherwise complies with Contract requirements.
4. Performance Specification Requirements: Where Specifications require compliance with performance requirements, provide products that comply with these requirements, and are recommended by the manufacturer for the application indicated. General overall performance of a product is implied where the product is specified for a specific application.
a. Manufacturer's recommendations may be contained in published product literature, or by the manufacturer's certification of performance.
5. Compliance with Standards, Codes, and Regulations: Where the Specifications only require compliance with an imposed code, standard, or regulation select a product that complies with the standards, codes, or regulations specified.

6. Visual Matching: Where Specifications require matching an established Sample, the Architect's decision will be final on whether a proposed product matches satisfactorily.
7. Visual Selection: Where specified product requirements include the phrase "...as selected from manufacturer's standard colors, patterns, textures..." or a similar phrase, select a product and manufacturer that complies with other specified requirements. The Architect will select the color, pattern, and texture from the product line selected.

2.02 EXISTING PRODUCTS

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

B. Unforeseen historic items encountered remain the property of the Owner; notify Owner promptly upon discovery; protect, remove, handle, and store as directed by Owner.

C. 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.

2.03 NEW PRODUCTS

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

B. Use of products having any of the following characteristics is not permitted:
1. Made using or containing CFC's or HCFC's.
2. Made of wood from newly cut old growth timber.
3. Containing lead, cadmium, or asbestos.

C. Where other criteria are met, Contractor shall give preference to products that:
1. If used on interior, have lower emissions, as defined in Section 01 6116.
2. If wet-applied, have lower VOC content, as defined in Section 01 6116.
3. Are extracted, harvested, and/or manufactured closer to the location of the project.
4. Have longer documented life span under normal use.
5. Result in less construction waste. See Section 01 7419
6. Are made of vegetable materials that are rapidly renewable.
7. Are made of recycled materials.
8. If made of wood, are made of sustainably harvested wood, wood chips, or wood fiber.
9. Have a published Environmental Product Declaration (EPD).
10. Have a published Health Product Declaration (HPD).
11. Are Living Building Challenge Red List Free.
12. Have a published Declare Label.

2.04 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.

2.05 MAINTENANCE MATERIALS

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

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

PART 3 EXECUTION

3.01 SUBSTITUTION LIMITATIONS

A. See Section 01 2500 - Substitution Procedures.

3.02 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. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.

B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.

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

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

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

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

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

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

3.04 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. See Section 01 7419.

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

C. Store with seals and labels intact and legible.

D. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.

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

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

G. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.

H. Comply with manufacturer's warranty conditions, if any.

I. Do not store products directly on the ground.

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

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

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

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

3.05 INSTALLATION OF PRODUCTS

A. Comply with manufacturer's instructions and recommendations for installation of products in the applications indicated. Anchor each product securely in place, accurately located and aligned with other Work.

B. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

END OF SECTION

SECTION 01 6116 - VOLATILE ORGANIC COMPOUND (VOC) CONTENT

RESTRICTIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for Indoor-Emissions-Restricted products.

B. Requirements for VOC-Content-Restricted products.

1.02 RELATED REQUIREMENTS

A. Section 01 3000 - Administrative Requirements: Submittal procedures.

B. Section 01 4000 - Quality Requirements: Procedures for testing and certifications.

C. Section 01 6000 - Product Requirements: Fundamental product requirements, substitutions and product options, delivery, storage, and handling.

1.03 DEFINITIONS

A. Indoor-Emissions-Restricted Products: All products in the following product categories, whether specified or not:

1. Interior paints and coatings applied on site.
2. Interior adhesives and sealants applied on site, including flooring adhesives.
3. Flooring.
4. Composite wood.
5. Products making up wall and ceiling assemblies.
6. Other products when specifically stated in the specifications.

B. VOC-Content-Restricted Products: All products in the following product categories, whether specified or not:

1. Interior paints and coatings applied on site.
2. Interior adhesives and sealants applied on site, including flooring adhesives.
3. Wet-applied roofing and waterproofing.
4. Other products when specifically stated in the specifications.

C. Interior of Building: Anywhere inside the exterior weather barrier.

D. Adhesives: All gunnable, trowelable, liquid-applied, and aerosol adhesives, whether specified or not; including flooring adhesives, resilient base adhesives, and pipe jointing adhesives.

E. Sealants: All gunnable, trowelable, and liquid-applied joint sealants and sealant primers, whether specified or not; including firestopping sealants and duct joint sealers.

F. Inherently Non-Emitting Materials: Products composed wholly of minerals or metals, unless they include organic-based surface coatings, binders, or sealants; and specifically the following:

1. Concrete.
2. Metals that are plated, anodized, or powder-coated.
3. Glass.
4. Ceramics.
5. Solid wood flooring that is unfinished and untreated.

1.04 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 D3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings; 2025.

C. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers Version 1.2; 2017.

D. CARB (ATCM) - Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products; Current Edition.

E. CARB (SCM) - Suggested Control Measure for Architectural Coatings; California Air Resources Board; 2020.

F. CHPS (HPPD) - High Performance Products Database; Current Edition.

G. CRI (GLP) - Green Label Plus Testing Program - Certified Products; Current Edition.

H. SCAQMD 1113 - Architectural Coatings; 1977, with Amendment (2016).

I. SCAQMD 1168 - Adhesive and Sealant Applications; 1989, with Amendment (2022).

J. SCS (CPD) - SCS Certified Products; Current Edition.

K. UL (GGG) - GREENGUARD Gold Certified Products; Current Edition.

1.05 SUBMITTALS

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

B. Product Data: For each VOC-restricted product used in the project, submit evidence of compliance.

1.06 QUALITY ASSURANCE

A. Indoor Emissions Standard and Test Method: CAL (CDPH SM), using Standard Private Office exposure scenario and the allowable concentrations specified in the method, and range of total VOC's after 14 days.

1. Wet-Applied Products: State amount applied in mass per surface area.
2. Paints and Coatings: Test tinted products, not just tinting bases.
3. Evidence of Compliance: Acceptable types of evidence are the following;
    a. Current UL (GGG) certification.
    b. Current SCS (CPD) Floorscore certification.
    c. Current SCS (CPD) Indoor Advantage Gold certification.
    d. Current listing in CHPS (HPPD) as a low-emitting product.
    e. Current CRI (GLP) certification.
    f. Test report showing compliance and stating exposure scenario used.
4. Product data submittal showing VOC content is NOT acceptable evidence.
5. Manufacturer's certification without test report by independent agency is NOT acceptable evidence.

B. VOC Content Test Method: 40 CFR 59, Subpart D (EPA Method 24), or ASTM D3960, unless otherwise indicated.

1. Evidence of Compliance: Acceptable types of evidence are:
    a. Report of laboratory testing performed in accordance with requirements.
    b. Published product data showing compliance with requirements.

C. Composite Wood Emissions Standard: CARB (ATCM) for ultra-low emitting formaldehyde (ULEF) resins.

1. Evidence of Compliance: Acceptable types of evidence are:

a. Current SCS "No Added Formaldehyde (NAF)" certification; www.scscertified.com.
b. Report of laboratory testing performed in accordance with requirements.
c. Published product data showing compliance with requirements.

D. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

PART 2 PRODUCTS

2.01 MATERIALS

A. All Products: Comply with the most stringent of federal, State, and local requirements, or these specifications.

B. Indoor-Emissions-Restricted Products: Comply with Indoor Emissions Standard and Test Method, except for:
1. Composite Wood, Wood Fiber, and Wood Chip Products: Comply with Composite Wood Emissions Standard or contain no added formaldehyde resins.
2. Inherently Non-Emitting Materials.

C. VOC-Content-Restricted Products: VOC content not greater than required by the following:
1. Adhesives, Including Flooring Adhesives: SCAQMD 1168 Rule.
2. Joint Sealants: SCAQMD 1168 Rule.
3. Paints and Coatings: Each color; most stringent of the following:
a. 40 CFR 59, Subpart D.
b. SCAQMD 1113 Rule.
c. CARB (SCM).
4. Wet-Applied Roofing and Waterproofing: Comply with requirements for paints and coatings.

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

A. Owner reserves the right to reject non-compliant products, whether installed or not, and require their removal and replacement with compliant products at no extra cost to Owner.

B. Additional costs to restore indoor air quality due to installation of non-compliant products will be borne by Contractor.

END OF SECTION

SECTION 01 7000 - EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

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

C. Cutting and patching.

D. Cleaning and protection.

E. Starting of systems and equipment.

F. Demonstration and instruction of Owner personnel.

G. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.

H. General requirements for maintenance service.

1.02 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.

B. Section 01 3000 - Administrative Requirements: Submittals procedures.

C. Section 01 4000 - Quality Requirements: Testing and inspection procedures.

D. Section 01 7800 - Closeout Submittals: Project record documents, operation and maintenance data, warranties, and bonds.

E. Section 07 8400 - Firestopping.

1.03 REFERENCE STANDARDS

A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2022, with Errata (2021).

1.04 SUBMITTALS

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

B. 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.

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

1.05 COORDINATION

A. See Section 01 1000 for occupancy-related requirements.

B. 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.

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

D. 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.

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

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

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

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

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

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

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

C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

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

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

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

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

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

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

3.02 PREPARATION

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

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

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

3.03 LAYING OUT THE WORK

A. Promptly notify Architect of any discrepancies discovered.

3.04 GENERAL INSTALLATION REQUIREMENTS

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

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

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

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

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

3.05 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 indicated.
   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 rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction specified.
   2. Remove items indicated on drawings.
   3. Relocate items indicated on drawings.
   4. 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.
   5. 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. See Section 01 1000 for other limitations on outages and required notifications.

c. 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 (6 mm) 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.

3.06 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-complying 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 skilled and experienced installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

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

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

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

I. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 8400, to full thickness of the penetrated element.

J. Patching:

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

3.07 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

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

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

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

3.08 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

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

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

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

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

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

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

3.09 SYSTEM STARTUP

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

B. Notify Architect and Owner seven days prior to start-up of each item.

C. 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.

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

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

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

G. 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.

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

3.10 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's 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.

3.11 ADJUSTING

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

3.12 FINAL CLEANING

A. Use cleaning materials that are nonhazardous.

B. 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.

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

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

E. Clean filters of operating equipment.

F. Clean debris from roofs and drainage systems.

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

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

3.13 CLOSEOUT PROCEDURES

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

B. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.

C. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.

D. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.

E. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.

F. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.

G. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.

H. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

3.14 MAINTENANCE

A. Provide service and maintenance of components indicated in specification sections.

B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.

C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.

D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.

E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

END OF SECTION

SECTION 01 7419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.01 WASTE MANAGEMENT REQUIREMENTS

A. Owner requires that this project be proactive on generating less trash and waste.

B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.

C. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.

D. Required Recycling, Salvage, and Reuse: The following may not be disposed of in landfills or by incineration:

1. Aluminum and plastic beverage containers.
2. Corrugated cardboard.
3. Wood pallets.
4. Clean dimensional wood: May be used as blocking or furring.
5. Metals, including packaging banding, metal studs, sheet metal, structural steel, piping, reinforcing bars, door frames, and other items made of steel, iron, galvanized steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.

E. Methods of trash/waste disposal that are not acceptable are:

1. Burning on the project site.
2. Burying on the project site.
3. Dumping or burying on other property, public or private.
4. Other illegal dumping or burying.

F. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.02 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: List of items to be salvaged from the existing building for relocation in project or for Owner.

B. Section 01 3000 - Administrative Requirements: Additional requirements for project meetings, reports, submittal procedures, and project documentation.

C. Section 01 5000 - Temporary Facilities and Controls: Additional requirements related to trash/waste collection and removal facilities and services.

D. Section 01 6000 - Product Requirements: Waste prevention requirements related to delivery, storage, and handling.

E. Section 01 7000 - Execution and Closeout Requirements: Trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

1.03 DEFINITIONS

A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.

B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.

C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.
D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.
E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.
F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.
G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.
H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
I. Return: To give back reusable items or unused products to vendors for credit.
J. Reuse: To reuse a construction waste material in some manner on the project site.
K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.
L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.
M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.
N. Toxic: Poisonous to humans either immediately or after a long period of exposure.
O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.
P. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

PART 2 PRODUCTS

PART 3 EXECUTION

3.01 WASTE MANAGEMENT PROCEDURES

A. See Section 01 3000 for additional requirements for project meetings, reports, submittal procedures, and project documentation.
B. See Section 01 6000 for waste prevention requirements related to delivery, storage, and handling.
C. See Section 01 7000 for trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

END OF SECTION

SECTION 01 7800 - CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project record documents.
B. Operation and maintenance data.
C. Warranties and bonds.

1.02 RELATED REQUIREMENTS

A. Section 01 3000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.
B. Section 01 7000 - Execution and Closeout Requirements: Contract closeout procedures.
C. Individual Product Sections: Specific requirements for operation and maintenance data.
D. 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. 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.
    2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
    3. 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.
    4. Submit two sets of revised final documents in final form within 10 days after final inspection.
C. Warranties and Bonds:
    1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
    2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
    3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:
    1. Drawings.
    2. Specifications.
    3. Addenda.
    4. Change Orders and other modifications to the Contract.

5. Reviewed shop drawings, product data, and samples.
6. Manufacturer's instruction for assembly, installation, and adjusting.

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

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

D. Record information concurrent with construction progress.

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

F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
1. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
2. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
3. Field changes of dimension and detail.
4. Details not on original Contract drawings.

3.02 OPERATION AND MAINTENANCE DATA

A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

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

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

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

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. For Each Product, Applied Material, and Finish:
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.

C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.

D. Additional information as specified in individual product specification sections.

E. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. For Each Item of Equipment and Each System:

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

B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

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

D. Include color coded wiring diagrams as installed.

E. 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.

F. 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.

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

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

I. Include sequence of operation by controls manufacturer.

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

K. Provide control diagrams by controls manufacturer as installed.

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

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

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

O. Include test and balancing reports.

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

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.

B. Where systems involve more than one specification section, provide separate tabbed divider for each system.

C. Binders: Commercial quality, 8-1/2 by 11 inch (216 by 280 mm) three D side ring binders with durable plastic covers; 2 inch (50 mm) 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. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.

F. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.

G. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.

H. Text: Manufacturer's printed data, or typewritten data on 20 pound paper.

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

J. Arrangement of Contents: Organize each volume in parts as follows:

1. Project Directory.
2. Table of Contents, of all volumes, and of this volume.
3. Operation and Maintenance Data: Arranged by system, then by product category.
    a. Source data.
    b. Product data, shop drawings, and other submittals.
    c. Operation and maintenance data.
    d. Field quality control data.
    e. Photocopies of warranties and bonds.
4. Design Data: To allow for addition of design data furnished by Architect or others, provide a tab labeled "Design Data" and provide a binder large enough to allow for insertion of at least 20 pages of typed text.

3.06 WARRANTIES AND BONDS

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

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

C. Co-execute submittals when required.

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

E. Manual: Bind in commercial quality 8-1/2 by 11 inch (216 by 279 mm) 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 2000 - 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 3000 - Cast-in-Place Concrete.

1.03 REFERENCE STANDARDS

A. ACI MNL-66 - ACI Detailing Manual; 2020.

B. ACI SPEC-301 - Specifications for Concrete Construction; 2020.

C. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2024.

D. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2024.

E. CRSI (DA4) - Manual of Standard Practice; 2024.

1.04 SUBMITTALS

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

B. Shop Drawings: Comply with requirements of ACI MNL-66 Include bar schedules, shapes of bent bars, spacing of bars, and location of splices.

C. Manufacturer's Certificate: Certify that products supplied for this project meet or exceed specified requirements.

D. Reports: Submit certified copies of mill test report of reinforcement materials analysis.

1.05 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI SPEC-301.

PART 2 PRODUCTS

2.01 REINFORCEMENT

A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi) (420 MPa).

1. Deformed billet-steel bars.
2. Unfinished.

B. Steel Welded Wire Reinforcement (WWR): Plain type; ASTM A1064/A1064M.

1. Form: Flat Sheets.

C. Reinforcement Accessories:

1. Tie Wire: Annealed, minimum 16 gauge, 0.0508 inch (1.29 mm).
2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.
3. Provide stainless steel components for placement within 1-1/2 inches (38 mm) of weathering surfaces, unless noted otherwise on Structural drawings. Wood materials are prohibited.

2.02 FABRICATION

A. Fabricate concrete reinforcing in accordance with CRSI (DA4) - Manual of Standard Practice.

B. Welding of reinforcement is not permitted.

C. Locate reinforcing splices not indicated on drawings at point of minimum stress.

1. Review locations of splices with Structural Engineer.

PART 3 EXECUTION

3.01 PLACEMENT

A. Place, support and secure reinforcement against displacement. Do not deviate from required position.

1. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

B. Do not cut, puncture, displace or damage vapor barrier. Repair damage and reseal vapor retarder before placing concrete.

C. Accommodate placement of formed openings.

D. Comply with applicable code for concrete cover over reinforcement.

E. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

F. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

3.02 FIELD QUALITY CONTROL

A. An independent testing agency, as specified in Section 01 4000 - Quality Requirements, will inspect installed reinforcement for compliance with contract documents before concrete placement.

END OF SECTION

SECTION 03 3000 - CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete formwork.
B. Floors and slabs on grade.
C. Concrete foundation walls.
D. Joint devices associated with concrete work.
E. Miscellaneous concrete elements, including equipment pads.
F. Concrete curing.

1.02 RELATED REQUIREMENTS

A. Section 03 2000 - Concrete Reinforcing.
B. Section 07 9200 - Joint Sealants: Products and installation for sealants and joint fillers for saw cut joints and isolation joints in slabs.

1.03 REFERENCE STANDARDS

A. ACI CODE-318 - Building Code Requirements for Structural Concrete and Commentary; 2019 (Reapproved 2022).
B. ACI PRC-211.1 - Selecting Proportions for Normal-Density and High Density-Concrete - Guide; 2022.
C. ACI PRC-304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000 (Reapproved 2009).
D. ACI PRC-305 - Guide to Hot Weather Concreting; 2020.
E. ACI PRC-306 - Guide to Cold Weather Concreting; 2016.
F. ACI PRC-308 - Guide to External Curing of Concrete; 2016.
G. ACI PRC-347 - Guide to Formwork for Concrete; 2014 (Reapproved 2021).
H. ACI SPEC-117 - Specification for Tolerances for Concrete Construction and Materials; 2010 (Reapproved 2015).
I. ACI SPEC-301 - Specifications for Concrete Construction; 2020.
J. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2024a.
K. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2024.
L. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2017a.
M. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens); 2016a.
N. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2020.
O. ASTM C150/C150M - Standard Specification for Portland Cement; 2024.
P. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete; 2020.
Q. ASTM C618 - Standard Specification for Coal Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2025a.
R. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2020.
S. ASTM C1116/C1116M - Standard Specification for Fiber-Reinforced Concrete; 2023.

T. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete; 2022.
U. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types); 2004, with Editorial Revision (2013).
V. ASTM D2103 - Standard Specification for Polyethylene Film; 2023a.
W. ASTM E1643 - Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs; 2024.
X. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs; 2017 (Reapproved 2023).
Y. COE CRD-C 513 - Handbook for Concrete and Cement Corps of Engineers Specifications for Rubber Waterstops; 1974.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.
    1. For curing compounds, provide data on method of removal in the event of incompatibility with floor covering adhesives.
C. Mix Design: Submit proposed concrete mix design.
    1. Employ an independent testing laboratory to test proposed aggregate and design concrete mixes for each type of concrete required.
    2. Submit aggregate test reports and mix designs for approval 14 days prior to placing concrete.
    3. Test each type of fine and coarse aggregate for conformance to ASTM C33-78.
    4. Design mixes in accordance with ACI 301, Section 3.8.2, Method 1 or Method 2.
    5. Indicate proposed mix design complies with fiber reinforcing manufacturer's written recommendations.
D. Samples: Submit samples of underslab vapor retarder to be used.
E. Test Reports: Submit report for each test or series of tests specified.
F. Manufacturer's Installation Instructions: For concrete accessories, indicate installation procedures and interface required with adjacent construction.
G. 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 SPEC-301 and ACI CODE-318.
B. Follow recommendations of ACI PRC-305 when concreting during hot weather.
C. Follow recommendations of ACI PRC-306 when concreting during cold weather.

PART 2 PRODUCTS

2.01 FORMWORK

A. Formwork Design and Construction: Comply with guidelines of ACI PRC-347 to provide formwork that will produce concrete complying with tolerances of ACI SPEC-117.
B. Form Materials: Contractor's choice of standard products with sufficient strength to withstand hydrostatic head without distortion in excess of permitted tolerances.

1. Form Facing for Exposed Finish Concrete: Contractor's choice of materials that will provide smooth, stain-free final appearance.
2. Earth Cuts: Do not use earth cuts as forms for vertical surfaces. Natural rock formations that maintain a stable vertical edge may be used as side forms.
3. Form Coating: Release agent that will not adversely affect concrete or interfere with application of coatings.
4. Form Ties: Cone snap type that will leave no metal within 1-1/2 inches (38 mm) of concrete surface.

2.02 REINFORCEMENT MATERIALS

A. Comply with requirements of Section 03 2000.

2.03 CONCRETE MATERIALS

A. Cement: ASTM C150/C150M, Type I/II Portland type, unless noted otherwise in Structural Drawings.
B. Fine and Coarse Aggregates: ASTM C33/C33M.
   1. Acquire aggregates for entire project from same source.
C. Fly Ash: ASTM C618, Class C or F.
D. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.
E. Structural Fiber Reinforcement: ASTM C1116/C1116M.

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.

2.05 ACCESSORY MATERIALS

A. Underslab Vapor Retarder (VPR RET-4):
   1. Sheet Material: ASTM E1745, Class A; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs. Single-ply polyethylene is prohibited.
   2. Permeance of less than 0.01 perms as tested in accordance with ASTM F 1249.
   3. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations.
   4. Products:
      a. ISI Building Products; Viper VaporCheck II 15-mil (Class A): www.isibp.com.
      b. Poly-America; Husky Yellow Guard 15-mil Vapor Barrier: www.yellowguard.com.
      c. Stego Industries, LLC; Stego Wrap Vapor Barrier (15-mil): www.stegoindustries.com.
      d. W. R. Meadows, Inc; PERMINATOR Class A - 15 mils (0.38 mm): www.wrmeadows.com.
      e. Viaflex; VaporBlock VB 15: www.viaflex.com.
      f. Substitutions: See Section 01 6000 - Product Requirements.
B. Non-Shrink Cementitious Grout: Premixed compound consisting of nonmetallic aggregate, cement, water reducing and plasticizing agents.
   1. Grout: Comply with ASTM C1107/C1107M.
   2. Minimum Compressive Strength at 48 Hours, ASTM C109/C109M: 2,000 pounds per square inch (13.7 MPa).
   3. Minimum Compressive Strength at 28 Days, ASTM C109/C109M: 7,000 pounds per square inch (48 MPa).

2.06 BONDING AND JOINTING PRODUCTS

A. Waterstops: Rubber, complying with COE CRD-C 513.

1. Configuration: As indicated on drawings.
2. Size: As indicated on drawings.

B. Slab Isolation Joint Filler: 1/2-inch (13 mm) thick, height equal to slab thickness, with removable top section forming 1/2-inch (13 mm) deep sealant pocket after removal.
1. Material: ASTM D1751, cellulose fiber.

C. Slab Construction Joint Devices: Combination keyed joint form and screed, galvanized steel, with rectangular or round knockout holes for conduit or rebar to pass through joint form at 6 inches (150 mm) on center; ribbed steel stakes for setting.

2.07 CURING MATERIALS

A. Curing and Sealing Compound, Low Gloss (CSLR-1): Liquid, membrane-forming, clear, non-yellowing acrylic; complying with ASTM C1315 Type 1 Class A.
1. Apply in accordance with manufacturer's instructions during concrete curing.
2. Near Substantial Completion, apply a final coat(s) to produce a consistent, uniform low gloss finish to floor areas indicated to receive (CSLR-1).
3. Solids by Mass: 25 percent, minimum.
4. Products:
a. Dayton Superior Corporation; Cure & Seal 1315 J22WB: www.daytonsuperior.com.
b. TCC Materials; Tenon Cure & Seal WB 1315: www.tccmaterials.com.
c. W. R. Meadows, Inc; VOCOMP-25: www.wrmeadows.com.
d. BASF; Kure 1315: www.buildingsystems.basf.com.
e. Scofield; Cureseal-W: www.scofield.com.
f. Substitutions: See Section 01 6000 - Product Requirements.

B. Moisture-Retaining Sheet: ASTM C171.
1. Curing paper, regular.
2. White-burlap-polyethylene sheet, weighing not less than 3.8 ounces per square yard (1.71 kg/sq m).

C. Polyethylene Film: ASTM D2103, 4 mil, 0.004 inch (0.102 mm) thick, clear.

D. Water: Potable, not detrimental to concrete.

2.08 CONCRETE MIX DESIGN

A. Proportioning Normal Weight Concrete: Comply with ACI PRC-211.1 recommendations.

B. Admixtures: Add acceptable admixtures as recommended in ACI PRC-211.1 and at rates recommended or required by manufacturer.

C. Fiber Reinforcement: Add to mix at rate of 1.5 pounds per cubic yard (0.89 kg per cu m), or as recommended by manufacturer for specific project conditions.

2.09 MIXING

A. Transit Mixers: Comply with ASTM C94/C94M.

B. Adding Water: If concrete arrives on-site with slump less than suitable for placement, do not add water that exceeds the maximum water-cement ratio or exceeds the maximum permissible slump.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.02 PREPARATION

A. Formwork: Comply with requirements of ACI SPEC-301. Design and fabricate forms to support all applied loads until concrete is cured and for easy removal without damage to concrete.

B. Verify that forms are clean and free of rust before applying release agent.

C. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.

D. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning and applying bonding agent in according to bonding agent manufacturer's instructions.

E. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.

F. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade. Comply with ASTM E1643. Lap joints minimum 6 inches (150 mm). Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor retarder before covering.

3.03 PLACING CONCRETE

A. Place concrete in accordance with ACI PRC-304.

B. Notify Architect not less than 24 hours prior to commencement of placement operations.

C. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

D. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.

E. Place concrete continuously without construction (cold) joints wherever possible; where construction joints are necessary, before next placement prepare joint surface by removing laitance and exposing the sand and sound surface mortar, by sandblasting or high-pressure water jetting.

3.04 SLAB JOINTING

A. Locate joints as indicated on 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.

1. Install wherever necessary to separate slab from other building members, including columns, walls, equipment foundations, footings, stairs, manholes, sumps, and drains.

D. Saw Cut Contraction Joints: Saw cut joints before concrete begins to cool, within 4 to 12 hours after placing; use 3/16 inch (5 mm) thick blade and cut at least 1 inch (25 mm) deep but not less than one quarter (1/4) the depth of the slab.

E. Construction Joints: Where not otherwise indicated, use metal combination screed and key form, with removable top section for joint sealant.

3.05 FLOOR FLATNESS AND LEVELNESS TOLERANCES

A. Maximum Variation of Surface Flatness:

1. Exposed Concrete Floors: 1/4 inch (6 mm) in 10 feet (3 m).
2. Under Seamless Resilient Flooring: 1/4 inch (6 mm) in 10 feet (3 m).
3. Under Carpeting: 1/4 inch (6 mm) in 10 feet (3 m).

B. Correct the slab surface if tolerances are less than specified.

C. 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.

3.06 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 (6 mm) or more in height.

C. Exposed Form Finish: Rub down or chip off and smooth fins or other raised areas 1/4 inch (6 mm) 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. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at 1:50 nominal, unless noted otherwise in the drawings.

3.07 CURING AND PROTECTION

A. Comply with requirements of ACI PRC-308. 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.

3.08 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - 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 compliance 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 100 cubic yards (76 cu m) 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.

3.09 DEFECTIVE CONCRETE

A. Defective Concrete: Concrete not complying with required lines, details, dimensions, tolerances or specified requirements.

B. Repair or replacement of defective concrete will be determined by the Architect. The cost of additional testing shall be borne by Contractor when defective concrete is identified.

C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect for each individual area.

3.10 PROTECTION

A. Do not permit traffic over unprotected concrete floor surface until fully cured.

END OF SECTION

SECTION 03 3511 - CONCRETE FLOOR FINISHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface treatments.

B. Polished concrete.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Finishing of concrete surface to tolerance; floating, troweling, and similar operations; curing.

B. Section 03 3000 - Cast-in-Place Concrete: Curing compounds that also function as sealers.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

B. Coordinate the work with concrete floor placement and concrete floor curing.

1.04 SUBMITTALS

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

B. Product Data: Manufacturer's published data on each finishing product, including information on compatibility of different products and limitations.

C. Maintenance Data: Provide data on maintenance and renewal of applied finishes.

1.05 MOCK-UPS

A. For coatings, construct mock-up area under conditions similar to those that will exist during application, with coatings applied.

B. Locate where directed.

C. Mock-up may remain as part of the work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's sealed packaging, including application instructions.

1.07 FIELD CONDITIONS

A. Maintain light level equivalent to a minimum 200 W light source at 8 feet (2.5 m) above the floor surface over each 20 foot (6 m) square area of floor being finished.

B. Do not finish floors until interior heating system is operational.

C. Maintain ambient temperature of 50 degrees F (10 degrees C) minimum.

PART 2 PRODUCTS

2.01 POLISHED CONCRETE SYSTEM

A. Polished Concrete System (PCONC-1): Materials, equipment, and procedures designed and furnished by a single manufacturer to produce dense polished concrete of the specified sheen.

1. (PCONC-1): No stain.
2. (SPCONC-1): Stained polished concrete.
    a. Level of Cut:
        1) Class B – Fine Aggregate (Salt/Pepper) Finish - Expose the fine aggregate such as sand and small aggregate with the concrete. The depth of grind will depend greatly on the

placement and finishing procedures. Generally, this level of cut can be achieved within 1/16” of the surface.

b. Level of Sheen:
   1) Level 3 Sheen Semi-Polished (Medium High Reflective) as determined by a gloss reading of 25 – 70 (400 – 800 grit)
c. Products:
d. L&M Construction Chemicals, Inc, a subsidiary of Laticrete International, Inc; FGS Permashine Concrete Polishing System: www.lmcc.com.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that floor surfaces are acceptable to receive the work of this section.
B. Verify that flaws in concrete have been patched and joints filled with methods and materials suitable for further finishes.

3.02 GENERAL

A. Apply materials in accordance with manufacturer's instructions.

3.03 PREPARATION

A. Ensure surfaces are clean and free of dirt and other foreign matter harmful to performance of concrete finishing materials.
B. Remove surface contamination

3.04 CONCRETE POLISHING

A. Provide consistent finish in all contiguous areas.
B. Apply floor finish prior to installation of fixtures and accessories.
C. Diamond polish concrete floor surfaces with power disc machine recommended by floor finish manufacturer. Sequence with coarse to fine grit. Installer to determine the optimum starting grit in order to achieve the specified aggregate exposure.
   1. Comply with manufacturer's recommended polishing grits for each sequence to achieve desired finish level. Following the initial passes of metal bond diamonds, the installer shall drop back a minimum of one grit level when transitioning to resin bond diamonds. The separation in grit designation shall be a minimum of 50 for the transitioning step. The installer shall refine each abrasive grit to its fullest potential before moving on to the next level. FLoor shall be thoroughly scrubbed between each grit pass to remove all loose material. Level of sheen shall match that of mock-up.
   2. Expose aggregate in concrete surface only as determined by approved mock-up.
   3. All concrete surfaces shall be as uniform in appearance as possible.
D. Apply manufacturer's recommended densifier, hardener as recommended for polishing system.
   1. Basis of Design: FGS Hardener Plus; two coats.
      a. First Coat: Install at 250 sf/gal, following 400 grit level.
      b. Second Coat: Install at 350 sf/gal, prior to the final polishing pass.
      c. Follow manufacturer's recommendations for drying time between successive coats.
E. Remove defects and re-polish defective areas.
F. Finish edges of floor finish adjoining other materials in a clean and sharp manner.

3.05 ADJUSTMENTS

A. Re-polish those areas not meeting specified gloss levels per mock-up.

B. Fill joints flush to surface prior to the start of polishing operations.

3.06 PROTECTION

A. Protect installed product from damage during construction.

END OF SECTION

SECTION 03 4100 - PRECAST STRUCTURAL CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Columns and bearing saddles.
B. Beams, spandrels, girders, purlins.
C. Grout packing.

1.02 REFERENCE STANDARDS

A. ACI CODE-318 - Building Code Requirements for Structural Concrete and Commentary; 2019 (Reapproved 2022).
B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
C. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2024.
D. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2024.
E. ASTM C150/C150M - Standard Specification for Portland Cement; 2024.
F. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025.
G. PCI MNL-116 - Manual for Quality Control for Plants and Production of Structural Precast Concrete Products; 2021.
H. PCI MNL-123 - Connections Manual: Design and Typical Details of Connections for Precast and Prestressed Concrete; 1988.
I. PCI MNL-135 - Tolerance Manual for Precast and Prestressed Concrete Construction; 2000.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Indicate standard component configurations, design loads, deflections, cambers, and bearing requirements.
C. Shop Drawings: Indicate layout, unit locations, fabrication details, unit identification marks, reinforcement, connection details, support items, dimensions, openings, and relationship to adjacent materials. Indicate design loads, deflections, cambers, bearing requirements, and special conditions.
D. Design Data: Submit design data reports indicating calculations for loadings and stresses of fabricated, designed framing.

1.04 QUALITY ASSURANCE

A. Designer Qualifications: Design precast concrete members under direct supervision of a Professional Structural Engineer experienced in design of precast concrete and licensed in the State in which the Project is located.
B. Fabricator Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience and in good standing in the PCI Plant Certification Program.
C. Erector Qualifications: Company specializing in erecting products of this section with not less than five years experience.

D. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and no more than 12 months before start of scheduled welding work.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Handle precast members in position consistent with their shape and design. Lift and support only from support points.

B. Lifting or Handling Devices: Capable of supporting member in positions anticipated during manufacture, storage, transportation, and erection.

C. Protect members to prevent staining, chipping, or spalling of concrete.

D. Mark each member with date of production and final position in structure.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Structural Precast Concrete:

1. Gage Brothers Concrete Products, Inc: gagebrothers.com.
2. Wells Concrete Products: www.wellsconcrete.com.
3. Molin Concrete Products: www.molin.com.
4. SteinBauer: www.steinbauerprecast.com.
5. Taracon Precast: www.taraconprecast.com.
6. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PRECAST UNITS

A. Precast Structural Concrete Units: Comply with PCI MNL-116, PCI MNL-120, PCI MNL-123, PCI MNL-135, ACI CODE-318, and applicable codes.

1. Design components to withstand dead loads and design loads in the configuration indicated on the drawings.
2. Calculate structural properties of framing members in accordance with ACI CODE-318.
3. Replace as much Portland cement as possible with fly ash, ground granulated blast furnace slag, silica fume, or rice hull ash as is consistent with strength requirements.
4. Design members exposed to the weather to provide for 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.
5. Design system to accommodate construction tolerances, deflection of other building structural members and clearances of intended openings.

2.03 MATERIALS

A. Cement: White Portland type, complying with ASTM C150/C150M, Type I.

B. Aggregate, Sand, Water, Admixtures: Determined by precast fabricator as appropriate to design requirements and PCI MNL-116.

2.04 REINFORCEMENT

A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi) (420 MPa).

1. Plain billet-steel bars.
2. Unfinished.

B. Steel Welded Wire Reinforcement: ASTM A1064/A1064M plain type or deformed type; in flat sheets; unfinished.

2.05 FABRICATION

A. Comply with fabrication procedures specified in PCI MNL-116.

B. Maintain plant records and quality control program during production of precast members. Make records available upon request.

C. Ensure reinforcing steel, anchors, inserts, plates, angles, and other cast-in items are embedded and located as indicated on shop drawings.

D. Provide required openings with a dimension larger than 8 inches and embed accessories provided under other sections of the specifications, at indicated locations.

2.06 FABRICATION TOLERANCES

A. Comply with fabrication tolerances specified in PCI MNL-135, except as specifically amended below.

1. Variation From Nominal Dimension: Plus or minus 1/2 inch (12.5 mm).
2. Variation From Intended Camber: Plus or minus 1/4 in per 10 ft (6 mm per 3 m), plus or minus 5/8 inch (15 mm) maximum.
3. Variation from End Squareness: Plus or minus 1/8 inch/12 in (3 mm/300 mm), maximum 3/8 in (9 mm).
4. Maximum Misalignment of Anchors, Inserts, Openings: Plus or minus 1/8 inch (3 mm).
5. Sweep: Plus or minus 1/4 inch (6 mm).

2.07 FINISHES

A. Ensure exposed-to-view finish surfaces of precast concrete members are uniform in color and appearance.

B. Cure members under identical conditions to develop required concrete quality, and minimize appearance blemishes such as non-uniformity, staining, or surface cracking.

C. Architectural Finish: Surface holes or bubbles over 1/4 inch (6 mm) filled with matching cementitious paste, fins or protrusions removed and surface ground smooth.

2.08 ACCESSORIES

A. Connecting and Supporting Devices; Anchors and Inserts: Plates, angles, items cast into concrete, items connected to steel framing members, and inserts complying with PCI MNL-123 and as follows:

1. Material: Carbon steel complying with ASTM A36/A36M.
2. Finish: Prime painted, except where device surfaces will be in contact with concrete or will require field welding.

B. Grout: Non-shrink, non-metallic, minimum yield strength of 10,000 psi (69 MPa) at 28 days.

C. Bearing Pads: High density plastic, Vulcanized elastomeric compound molded to size, Neoprene (Chloroprene), or Tetrafluoroethylene(TFE); Shore A Durometer as recommended by manufacturer; 1/8 inch (3 mm) thick, smooth both sides.

D. Bolts, Nuts and Washers: High strength steel type recommended for structural steel joints.

E. Prime Paint: Zinc rich alkyd type.

2.09 SOURCE QUALITY CONTROL

A. Section 01 4000 - Quality Requirements: Provide mix design for concrete.

B. Test samples in accordance with applicable ASTM standard.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that site conditions are ready to receive work and field measurements are as indicated on shop drawings.

3.02 PREPARATION

A. Prepare support equipment for the erection procedure, temporary bracing, and induced loads during erection.

3.03 ERECTION

A. Erect members without damage to structural capacity, shape, or finish. Replace or repair damaged members.
B. Align and maintain uniform horizontal and vertical joints, as erection progresses.
C. Maintain temporary bracing in place until final support is provided. Protect members from staining.
D. Provide temporary lateral support to prevent bowing, twisting, or warping of members.
E. Adjust differential camber between precast members to tolerance before final attachment.
F. Install bearing pads.
G. Level differential elevation of adjoining horizontal members with grout to maximum slope of 1:12.
H. Set vertical units dry, without grout, attaining joint dimension with lead or plastic spacers.
I. Grout underside of column bearing plates.
J. Secure units in place. Perform welding in accordance with AWS D1.1/D1.1M.

3.04 TOLERANCES

A. Erect members level and plumb within allowable tolerances.
B. Conform to PCI MNL-135 for erection tolerances.
C. When members cannot be adjusted to comply with design or tolerance criteria, cease work and advise Architect. Execute modifications as directed.

3.05 PROTECTION

A. Protect members from damage caused by field welding or erection operations.
B. Provide non-combustible shields during welding operations.

3.06 CLEANING

A. Clean weld marks, dirt, or blemishes from surface of exposed members.

END OF SECTION

SECTION 03 4113 - PRECAST CONCRETE HOLLOW CORE PLANKS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Precast floor planks.
B. Connection plates with brackets and hangers.
C. Grouting plank joint keys.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete.

1.03 REFERENCE STANDARDS

A. ACI CODE-318 - Building Code Requirements for Structural Concrete and Commentary; 2019 (Reapproved 2022).
B. ACI SPEC-301 - Specifications for Concrete Construction; 2020.
C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
D. ASTM A416/A416M - Standard Specification for Low-Relaxation, Seven-Wire Steel Strand for Prestressed Concrete; 2024.
E. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2024.
F. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2021, with Errata (2023).
G. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025.
H. AWS D1.4/D1.4M - Structural Welding Code - Steel Reinforcing Bars; 2018, with Amendment (2020).
I. PCI MNL-116 - Manual for Quality Control for Plants and Production of Structural Precast Concrete Products; 2021.
J. PCI MNL-120 - PCI Design Handbook; 2017, with Errata (2021).
K. PCI MNL-123 - Connections Manual: Design and Typical Details of Connections for Precast and Prestressed Concrete; 1988.
L. PCI MNL-124 - Design for Fire Resistance of Precast Prestressed Concrete; 2011.
M. PCI MNL-126 - PCI Manual for the Design of Hollow Core Slabs and Walls; 2015.
N. PCI MNL-135 - Tolerance Manual for Precast and Prestressed Concrete Construction; 2000.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate location of hanger tabs and devices for mechanical and electrical work and cutting of field openings.
B. Preinstallation Meeting: Convene one week before starting work of this section.
    1. Discuss anchor and weld plate locations, sleeve locations, and cautions regarding cutting or core drilling.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Indicate standard component configuration, design loads, deflections, and cambers.

C. Shop Drawings: Indicate plank locations, unit identification marks, connection details, edge conditions, bearing requirements, support conditions, dimensions, openings, openings intended to be field cut, and relationship to adjacent materials.

1.06 QUALITY ASSURANCE

A. Designer Qualifications: Design precast concrete hollow core planks 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. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of experience and in good standing in the PCI Plant Certification Program.

C. Erector Qualifications: Company specializing in performing the type of work specified in this section, with minimum five years of experience.

D. Welding Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and AWS D1.4/D1.4M and no more than 12 months before start of scheduled welding work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Lifting or Handling Devices: Capable of supporting member in positions anticipated during manufacture, storage, transportation, and erection.

B. Mark each member with date of production and final position in structure.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Precast Concrete Hollow Core Planks:

1. Gage Brothers Concrete Products, Inc: gagebrothers.com.
2. Molin Concrete Products: www.molin.com.
3. Wells Concrete Products: www.wellsconcrete.com.
4. SteinBauer: www.steinbauerprecast.com.
5. Taracon Precast: www.taraconprecast.com.
6. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PRECAST UNITS

A. Precast Hollow Core Planks: Comply with PCI MNL-120, PCI MNL-126, PCI MNL-124 ACI CODE-318, and ACI SPEC-301.

1. Dimensions as indicated on drawings.
2. Design components to withstand dead loads and design loads in the configuration indicated on the drawings.
3. Replace as much Portland cement as possible with fly ash, ground granulated blast furnace slag, silica fume, or rice hull ash as is consistent with strength requirements.
4. Design connections in accordance with PCI MNL-123.
5. Design components to accommodate construction tolerances, deflection of other building structural members and clearances of intended openings.

2.03 MATERIALS

A. Concrete Materials: ACI SPEC-301.

B. Tensioning Steel Tendons: ASTM A416/A416M, Grade 250 - 250K psi (1725 MPa); seven-wire stranded steel cable; low-relaxation type; full length without splices; weldless; uncoated.

C. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi) (420 MPa) deformed steel bars.

D. Non-Shrink Grout: Non-metallic, minimum compressive strength of 10,000 psi (69 MPa) at 28 days.

E. Cement Grout: Minimum compressive strength of 3,000 psi (21 MPa) at 28 days.

2.04 ACCESSORIES

A. Connecting and Supporting Devices: Plates, angles, items cast into concrete, items connected to steel framing members, and inserts: ASTM A36/A36M carbon steel; prime painted.

B. Core Hole End Plugs: Cardboard insert with stiff concrete fill.

C. Bearing Pads: High density plastic, 1/8 inch (3 mm) thick, smooth on one side. Vulcanized elastomeric compound molded to size.

D. Sill Seal: Compressible glass fiber strips.

2.05 FABRICATION

A. Weld reinforcing in accordance with AWS D1.4/D1.4M.

B. Embed anchors, inserts, plates, angles, and other items at locations indicated.

C. Provide openings required by other sections, at locations indicated.

D. Cut exposed ends flush.

E. Plant Finish: Finish members to PCI MNL-116 Commercial Grade.

2.06 FABRICATION TOLERANCES

A. Conform to PCI MNL-116 and PCI MNL-135.

2.07 SOURCE QUALITY CONTROL

A. Produce planks in accordance with requirements of PCI MNL-116. Maintain plant records and quality control program during production of precast planks. Make records available upon request.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that site conditions are ready to receive work and field measurements are as indicated on shop drawings.

3.02 PREPARATION

A. Prepare support devices for the erection procedure and temporary bracing.

3.03 ERECTION

A. Erect members without damage to structural capacity, shape, or finish. Replace or repair damaged members.

B. Install bearing pads and sill seal at bearing ends of planks as indicated.

C. Align and maintain uniform horizontal and end joints, as erection progresses.

D. Maintain temporary bracing in place until final connection is made. Protect members from staining.

E. Secure units in place. Perform welding in accordance with AWS D1.1/D1.1M.

F. Make plank-to-plank joints smooth using grout, troweled smooth. Transition differential elevation of adjoining planks with grout to a maximum slope of 1:12.

G. All units scheduled to be visible shall have smooth form finish with any voids filled smooth. Chips and other defects must be filled and finished on all exposed slabs.

3.04 TOLERANCES

A. Erect members level and plumb within allowable tolerances. Conform to PCI MNL-135.

3.05 PROTECTION

A. Protect members from damage caused by field welding or erection operations.

B. Provide clear instructions to all other contractors regarding allowable cutting or core drilling through the precast components. Provide engineering as required including written instructions for each instance where coring or cutting is required.

3.06 CLEANING

A. Clean weld marks, dirt, and blemishes from surface of exposed members.

END OF SECTION

SECTION 03 4500 - PRECAST ARCHITECTURAL CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Architectural precast concrete wall panels.
B. Supports, anchors, and attachments.
C. Grouting under panels.

1.02 RELATED REQUIREMENTS

A. Section 07 9200 - Joint Sealants: Sealing perimeter and intermediate joints.

1.03 REFERENCE STANDARDS

A. ACI CODE-318 - Building Code Requirements for Structural Concrete and Commentary; 2019 (Reapproved 2022).
B. ACI SPEC-301 - Specifications for Concrete Construction; 2020.
C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.
E. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.
F. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.
G. ASTM A563/A563M - Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric); 2021a.
H. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2024.
I. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete; 2022.
J. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2024a.
K. ASTM C150/C150M - Standard Specification for Portland Cement; 2024.
L. ASTM C330/C330M - Standard Specification for Lightweight Aggregates for Structural Concrete; 2017a.
M. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025.
N. PCI MNL-117 - Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products; 2013.
O. PCI MNL-120 - PCI Design Handbook; 2017, with Errata (2021).
P. PCI MNL-122 - Architectural Precast Concrete; 2007.
Q. PCI MNL-123 - Connections Manual: Design and Typical Details of Connections for Precast and Prestressed Concrete; 1988.
R. PCI MNL-135 - Tolerance Manual for Precast and Prestressed Concrete Construction; 2000.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Manufacturer's information on accessory products, including pigments, admixtures, inserts, plates, etc.

C. Shop Drawings: Indicate layout, unit locations, configuration, unit identification marks, reinforcement, integral insulation, insulated panel system connectors, connection details, support items, location of lifting devices, dimensions, openings, and relationship to adjacent materials. Provide erection drawings.
   1. Include details of mix designs.
   2. Include structural design calculations.

D. Fabricator's Qualification Statement: Provide documentation showing precast concrete fabricator is accredited under IAS AC157.

1.05 QUALITY ASSURANCE

A. Design Engineer Qualifications: Design precast concrete units under direct supervision of a Professional Structural Engineer experienced in design of precast concrete and licensed in the State in which the Project is located.

B. Fabricator Qualifications:
   1. Firm having at least 2 years of experience in production of precast concrete of the type required.
   2. Plant certified under Precast/Prestressed Concrete Institute Plant Certification Program; product group and Category AA.

C. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and no more than 12 months before start of scheduled welding work.

1.06 MOCK-UPS

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Locate where directed.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Handling: Lift and support precast units only from support points.

B. Blocking and Lateral Support During Transport and Storage: Use materials that are clean, non-staining, and non-harmful to exposed surfaces. Provide temporary lateral support to prevent bowing and warping.

C. Protect units to prevent staining, chipping, or spalling of concrete.

D. Mark units with date of production in location that will be concealed after installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Architectural Precast Concrete:
   1. Gage Brothers Concrete Products, Inc: gagebrothers.com.
   2. Molin Concrete Products: www.molin.com.
   3. SteinBauer: steinbauerprecast.com.
   4. Taracon Precast: www.taraconprecast.com.
   5. Wells Concrete Products: www.wellsconcrete.com.
   6. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PRECAST UNITS, GENERAL

A. Precast Architectural Concrete Units: Comply with PCI MNL-120, PCI MNL-122, PCI MNL-123, PCI MNL-135, and ACI CODE-318.
   1. Concrete Face Mix: Minimum 5000 psi (34 MPa), 28 day strength, air entrained to 5 to 7 percent; comply with ACI SPEC-301.

2. Design Loads: Static loads, anticipated dynamic loading, including positive and negative wind loads, thermal movement loads, and erection forces as defined by applicable code.
3. Calculate structural properties of units in accordance with ACI CODE-318.
4. Accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.
5. Provide connections that accommodate building movement and thermal movement and adjust to misalignment of structure without unit distortion or damage.
6. Control joints in individual panels are NOT acceptable.

B. Insulated Wall Panel (PC PNL-1): Precast concrete wall panel with foam insulation sandwiched by interior and exterior concrete. See drawings for thicknesses.

C. Wall Panel without Insulation (PC PNL-2): Precast concrete wall panel without insulation. See drawings for thicknesses.

D. Standard Float Finish (PCFIN-1): Screed or float finish uniform surfaces: Strike off and consolidate concrete with vibrating screeds to a uniform finish, float finish, if required. Hand screed at projections. Normal color variations, minor indentations, minor chips, and spalls are permitted. No major imperfections, honeycombing, or defects permitted.

E. ALTERNATE BID 4 - Formliner with Acid Etch Finish (PCFIN-20): Use acid and hot-water solution, equipment, application techniques, and cleaning procedures to expose aggregate and surrounding matrix surfaces. Protect hardware, connections, and insulation from acid attack. Provide joints and reveals as indicated in drawings. Architect to select final finish from manufacturer's samples.

F. BASE BID - Acid Etch (PCFIN-30): Acid etch, exposed-to-view precast unit surfaces to expose aggregate. Protect adjacent surfaces. Provide joints and reveals as indicated in drawings. Architect to select final finish from manufacturer's samples.

2.03 REINFORCEMENT

A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi) (420 MPa).
1. Deformed billet-steel bars.

2.04 CONCRETE MATERIALS

A. Mix Design: Basis of Design: Wells Concrete:
1. Federal White PLC-350 (Lehigh PLC-350)
2. Fort Dodge 1/2 inch - 1706
3. Cadet Gray MFG Sand - 1148
4. 0615 Cave Grey 1%

B. Cement: ASTM C150/C150M, Type I - Normal Portland type.

C. Fine and Coarse Structural Aggregates: ASTM C33/C33M.

D. Lightweight Structural Aggregate: ASTM C330/C330M.

E. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

F. Grout:
1. Non-shrink, non-metallic, minimum 10,000 psi (70 MPa), 28 day strength.

2.05 FORM LINERS

A. Material (PCFIN-20): Glass fiber reinforced polyester, Acrylonitrile butadiene styrene, Polyvinyl chloride, Polystyrene, or Polyurethane.
1. Basis of Design: Architectural Polymers Model Number: 515-S Old Timber Form: www.apformliner.com.

2.06 SUPPORT DEVICES

A. Connecting and Support Devices; Anchors and Inserts: ASTM A36/A36M steel; hot-dip galvanized in accordance with ASTM A153/A153M.
   1. Clean surfaces of rust, scale, grease, and foreign matter.
   2. Galvanize after fabrication in accordance with requirements of ASTM A123/A123M.
   3. Items not below grade or exposed to the elements, or areas of high moisture or chemical content need not be galvanized. Coordinate with Architect.

B. Bolts, Nuts, and Washers: ASTM A307 heavy hex bolts, Type A, hot-dip galvanized, with matching ASTM A563/A563M nuts and matching washers.

C. Primer: Zinc rich type.

2.07 FABRICATION

A. Fabricate in compliance with PCI MNL-117 and PCI MNL-135.

B. Maintain plant records and quality control program during production of precast units. Make records available upon request.

C. Use rigid molds, constructed to maintain precast unit uniform in shape, size, and finish.

D. Use form liners in accordance with manufacturer's instructions.

E. Place thin brick in form liner in accordance with manufacturer's instructions. Mix bricks from several cartons for uniform distribution of color variations.

F. Maintain consistent quality during manufacture.

G. Fabricate connecting devices, plates, angles, items fit to steel framing members, inserts, bolts, and accessories. Fabricate to permit initial placement and final attachment.

H. Embed reinforcing steel, anchors, inserts plates, angles, and other cast-in items.

I. Locate hoisting devices to permit removal after erection.

J. Cure units to develop concrete quality, and to minimize appearance blemishes such as non-uniformity, staining, or surface cracking.

K. Minor patching in plant is acceptable, providing structural adequacy and appearance of units is not impaired.

2.08 FABRICATION TOLERANCES

A. Conform to PCI MNL-117 and PCI MNL-135.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that building structure, anchors, devices, and openings are ready to receive work of this section.

3.02 PREPARATION

A. Provide for erection procedures and induced loads during erection. Maintain temporary bracing in place until final support is provided.

3.03 ERECTION

A. Erect units without damage to shape or finish. Replace or repair damaged panels.

B. Erect units level and plumb within allowable tolerances.

C. Align and maintain uniform horizontal and vertical joints as erection progresses.

D. When units require adjustment beyond design or tolerance criteria, discontinue affected work; advise Architect.

E. Weld units in place. Perform welding in accordance with AWS D1.1/D1.1M.

F. Provide non-combustible shields during welding operations.

G. Touch-up field welds and scratched or damaged primed painted surfaces.

H. Set vertical units dry, without grout, attaining joint dimension with lead or plastic spacers. Pack grout to base of unit.

I. Exposed Joint Dimension: 1/2 inch (12 mm). Adjust units so that joint dimensions are within tolerances.

3.04 TOLERANCES

A. Erect members level and plumb within allowable tolerances. Conform to PCI MNL-135.

END OF SECTION

SECTION 04 2000 - UNIT MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete block.
B. Mortar and grout.
C. Reinforcement and anchorage.
D. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 9200 - Joint Sealants: Sealing control and expansion joints.

1.03 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
B. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement; 2022.
C. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2017.
D. ASTM C67/C67M - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile; 2023.
E. ASTM C90 - Standard Specification for Dry-Cast Loadbearing Concrete Masonry Units; 2024a.
F. ASTM C91/C91M - Standard Specification for Masonry Cement; 2012.
G. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units; 2023.
H. ASTM C140/C140M - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units; 2024a.
I. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2017.
J. ASTM C150/C150M - Standard Specification for Portland Cement; 2018.
K. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2006 (Reapproved 2011).
L. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2014a.
M. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2011.
N. ASTM C476 - Standard Specification for Grout for Masonry; 2018.
O. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2017.
P. ASTM C1072 - Standard Test Method for Measurement of Masonry Flexural Bond Strength; 2013, with Editorial Revision (2014).
Q. ASTM C1314 - Standard Test Method for Compressive Strength of Masonry Prisms; 2016.
R. ASTM E514/E514M - Standard Test Method for Water Penetration and Leakage Through Masonry; 2014a.
S. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.
C. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

D. Manufacturer's Certificate: Certify that water repellent admixture manufacturer has certified masonry unit manufacturer as an approved user of water repellent admixture in the manufacture of concrete block.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

PART 2 PRODUCTS

2.01 PRODUCT REQUIREMENTS

A. Products listed as Basis of Design have been selected for specific criteria. Products from other manufacturer's listed herein, and/or substitutions will only be accepted if they meet, or exceed, the performance of the Basis of Design. Manufacturer must be able to provide documentation showing that the product meets, or exceeds, the Basis of Design.

2.02 CONCRETE MASONRY UNITS

A. Concrete Block: Comply with referenced standards and as follows:
   1. Size: Standard units with nominal face dimensions of 16 by 8 inches (400 by 200 mm) and nominal depths as indicated on drawings for specific locations.
   2. Special Shapes: Provide nonstandard blocks configured for corners.
   3. Load-Bearing Units: ASTM C90, normal weight.
      a. Hollow block.
   4. Nonloadbearing Units: ASTM C129.
      a. Hollow block.
   5. Patterns and Faces:
      a. (CMU-1): Manufacturer's standard color and texture.
      b. Supplier of prefinished or integrally colors units shall guarantee that the finished product will not be stained or damaged due to iron or shale deposits in the face for a period of 5 years.
   6. Units with Integral Water Repellent: Concrete block units as specified in this section with polymeric liquid admixture added to concrete masonry units at time of manufacture.
      a. Application: Provide integral water repellent in units exposed to the exterior.
      b. Performance of Units with Integral Water Repellent:
         1) Water Permeance: When tested per ASTM E514/E514M and for a minimum of 72 hours.
            (a) No water visible on back of wall above flashing at the end of 24 hours.
            (b) No flow of water from flashing equal to or greater than 0.032 gallons per hour (0.05 L per hour) at the end of 24 hours.
            (c) No more than 25 percent of wall area above flashing visibly damp at end of test.
         2) Flexural Bond Strength: ASTM C1072; minimum 10 percent increase.
         3) Compressive Strength: ASTM C1314; maximum 5 percent decrease.
      c. Use only in combination with mortar that also has integral water repellent admixture.
      d. Use water repellent admixtures for masonry units and mortar by a single manufacturer.

2.03 MORTAR AND GROUT MATERIALS

A. Masonry Cement: ASTM C91/C91M, Type S.

B. Portland Cement: ASTM C150/C150M, Type I.

C. Hydrated Lime: ASTM C207, Type S.

D. Mortar Aggregate: ASTM C144.
E. Grout Aggregate: ASTM C404.
F. Water: Clean and potable.
G. Integral Water Repellent Admixture for Mortar: Polymeric liquid admixture added to mortar at the time of manufacture.
    1. Use only in combination with masonry units manufactured with integral water repellent admixture.
    2. Use only water repellent admixture for mortar from the same manufacturer as water repellent admixture in masonry units.
    3. Meet or exceed performance specified for water repellent admixture used in masonry units.

2.04 REINFORCEMENT AND ANCHORAGE

A. Basis of Design: Hohmann & Barnard, Inc; www.h-b.com.
B. Other Acceptable Products provided they meet or exceed the Basis of Design performance requirements:
    1. Blok-Lok Limited: www.blok-lok.com.
    2. WIRE-BONDwww.wirebond.com/#sle.
    3. Substitutions: See Section 01 6000 - Product Requirements.
C. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi) (420 MPa), deformed billet bars; galvanized.
D. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.
E. Single Wythe Joint Reinforcement: ASTM A951/A951M.
    1. Type: Ladder.
    2. Material: ASTM A1064/A1064M steel wire, hot dip galvanized after fabrication to ASTM A153/A153M Class B.
    3. Size: 0.1483 inch (3.8 mm) side rods with 0.1483 inch (3.8 mm) cross rods; width as required to provide not less than 5/8 inch (16 mm) of mortar coverage on each exposure.

2.05 ACCESSORIES

A. Preformed Control Joints (CJ-1): Rubber material. Provide with corner and tee accessories, fused joints.
B. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.
    1. Acceptable Products: Contractor’s option to achieve the specified results without damage to masonry or surrounding materials, such as Sure Klean by Prosoco or other product with similar properties.
    2. Use in strict accordance with manufacturer's written instructions.

2.06 MORTAR AND GROUT MIXING

A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.
B. Grout: ASTM C476; consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches (50 mm) or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches (50 mm).
C. Admixtures: Add to mixture at manufacturer's recommended rate and in accordance with manufacturer's instructions; mix uniformly.
D. Mixing: Use mechanical batch mixer and comply with referenced standards.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry.
B. Verify that related items provided under other sections are properly sized and located.
C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 COLD AND HOT WEATHER REQUIREMENTS

A. Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

3.03 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.
B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
C. Concrete Masonry Units:
    1. Bond: Running.
    2. Mortar Joints: Concave.

3.04 PLACING AND BONDING

A. Lay hollow masonry units with face shell bedding on head and bed joints.
B. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.
C. Remove excess mortar and mortar smears as work progresses.
D. Remove excess mortar with water repellent admixture promptly. Do not use acids, sandblasting or high pressure cleaning methods.
E. Interlock intersections and external corners, except for units laid in stack bond.
F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
G. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
H. Isolate masonry partitions from vertical structural framing members with a control joint.
I. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

3.05 REINFORCEMENT AND ANCHORAGE - GENERAL AND SINGLE WYTHE MASONRY

A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches (400 mm) on center.
B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches (400 mm) each side of opening.
C. Lap joint reinforcement ends minimum 6 inches (150 mm).

3.06 LINTELS

A. Install loose steel lintels over openings.
B. Install reinforced unit masonry lintels over openings where steel or precast concrete lintels are not scheduled.
    1. Openings over 48 inches not scheduled: Contact Structural Engineer.

3.07 GROUTED COMPONENTS

A. Follow lap splice requirements as indicated in Structural drawings.

3.08 CONTROL AND EXPANSION JOINTS

A. Do not continue horizontal joint reinforcement through control or expansion joints.

B. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

C. Size control joints as indicated on drawings; if not indicated, 3/4 inch (19 mm) wide and deep.

3.09 TOLERANCES

A. Maximum Variation From Unit to Adjacent Unit: 1/16 inch (1.6 mm).

B. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft (6 mm/3 m) and 1/2 inch in 20 ft (13 mm/6 m) or more.

C. Maximum Variation from Plumb: 1/4 inch (6 mm) per story non-cumulative; 1/2 inch (13 mm) in two stories or more.

D. Maximum Variation from Level Coursing: 1/8 inch in 3 ft (3 mm/m) and 1/4 inch in 10 ft (6 mm/3 m); 1/2 inch in 30 ft (13 mm/9 m).

E. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch (minus 6.4 mm, plus 9.5 mm).

F. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch (6 mm).

3.10 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - Quality Requirements.

B. Clay Masonry Unit Tests: Test each variety of clay masonry in accordance with ASTM C67/C67M requirements, sampling 5 randomly chosen units for each 50,000 installed.

C. Concrete Masonry Unit Tests: Test each variety of concrete unit masonry in accordance with ASTM C140/C140M for compliance with requirements of this specification.

D. Mortar Tests: Test each type of mortar in accordance with ASTM C780, testing with same frequency as masonry samples.

3.11 CLEANING

A. Remove excess mortar and mortar droppings.

B. Clean soiled surfaces with cleaning solution.

3.12 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION

SECTION 05 1200 - STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Structural steel framing members.

B. Base plates, shear stud connectors.

1.02 RELATED REQUIREMENTS

A. Section 05 2100 - Steel Joist Framing.

B. Section 05 3100 - Steel Decking: Support framing for small openings in deck.

1.03 REFERENCE STANDARDS

A. AISC (MAN) - Steel Construction Manual; 2023, with Errata (2025).

B. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges; 2022, with Errata (2025).

C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

D. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished; 2024.

E. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2023.

F. ASTM A563/A563M - Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric); 2021a.

G. ASTM A992/A992M - Standard Specification for Structural Steel Shapes; 2022.

H. ASTM E94/E94M - Standard Guide for Radiographic Examination Using Industrial Radiographic Film; 2017.

I. ASTM E164 - Standard Practice for Contact Ultrasonic Testing of Weldments; 2024.

J. ASTM E165/E165M - Standard Practice for Liquid Penetrant Testing for General Industry; 2023.

K. ASTM E709 - Standard Guide for Magnetic Particle Testing; 2021.

L. ASTM F436/F436M - Standard Specification for Hardened Steel Washers Inch and Metric Dimensions; 2024.

M. ASTM F959/F959M - Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners, Inch and Metric Series; 2017a.

N. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi, 144 ksi, and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2025.

O. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.

P. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025.

Q. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172; 2019.

R. RCSC (HSBOLT) - Specification for Structural Joints Using High-Strength Bolts; Research Council on Structural Connections; 2020.

1.04 SUBMITTALS

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

B. Shop Drawings:

1. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.
2. Connections not detailed.

3. Indicate cambers and loads.
4. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.

C. Manufacturer's Mill Certificate: Certify that products meet or exceed specified requirements.

D. Mill Test Reports: Indicate structural strength, destructive test analysis and non-destructive test analysis.

1.05 QUALITY ASSURANCE

A. Fabricate structural steel members in accordance with AISC (MAN) "Steel Construction Manual."

B. Fabricator Qualifications: A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel in accordance with IAS AC172.

C. Erector: Company specializing in performing the work of this section with minimum five years of experience.

D. Design connections not detailed on drawings 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.

PART 2 PRODUCTS

2.01 MATERIALS

A. Steel Angles, Plates, and Channels: ASTM A36/A36M.

B. Steel W Shapes and Tees: ASTM A992/A992M.

C. Rolled Steel Structural Shapes: ASTM A992/A992M.

D. Cold-Formed Structural Tubing: ASTM A500/A500M, Grade A.

E. Shear Stud Connectors: Made from ASTM A108 Grade 1015 bars.

F. High-Strength Structural Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, with matching compatible ASTM A563/A563M nuts and ASTM F436/F436M washers.

G. Load Indicator Washers: Provide washers complying with ASTM F959/F959M at connections requiring high-strength bolts.

H. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

I. Shop and Touch-Up Primer: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.

J. Touch-Up Primer for Galvanized Surfaces: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

A. Shop fabricate to greatest extent possible.

B. Continuously seal joined members by continuous welds. Grind exposed welds smooth.

C. Fabricate connections for bolt, nut, and washer connectors.

D. Develop required camber for members.

2.03 FINISH

A. Shop prime structural steel members. Do not prime surfaces that will be fireproofed, field welded, in contact with concrete, or high strength bolted.

2.04 SOURCE QUALITY CONTROL

A. High-Strength Bolts: Provide testing and verification of shop-bolted connections in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts", testing at least 10 percent of bolts at each connection.

B. Welded Connections: Visually inspect all shop-welded connections and test at least 10 percent of welds using one of the following:

1. Radiographic testing performed in accordance with ASTM E94/E94M.
2. Ultrasonic testing performed in accordance with ASTM E164.
3. Liquid penetrant inspection performed in accordance with ASTM E165/E165M.
4. Magnetic particle inspection performed in accordance with ASTM E709.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that conditions are appropriate for erection of structural steel and that the work may properly proceed.

3.02 ERECTION

A. Erect structural steel in compliance with AISC 303.

B. Allow for erection loads and provide sufficient temporary bracing to maintain structure in safe condition, plumb, and in true alignment until completion of erection and installation of permanent bracing.

C. Field weld components and shear studs indicated on shop drawings.

D. Use carbon steel bolts only for temporary bracing during construction, unless otherwise specifically permitted on drawings. Install high-strength bolts in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts".

E. Do not field cut or alter structural members without approval of Architect.

F. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

3.03 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch (6 mm) per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch (6 mm).

3.04 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - Quality Requirements.

B. High-Strength Bolts: Provide testing and verification of field-bolted connections in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts", testing at least 10 percent of bolts at each connection.

C. Welded Connections: Visually inspect all field-welded connections and test at least 10 percent of welds using one of the following:

1. Radiographic testing performed in accordance with ASTM E94/E94M.
2. Ultrasonic testing performed in accordance with ASTM E164.
3. Liquid penetrant inspection performed in accordance with ASTM E165/E165M.
4. Magnetic particle inspection performed in accordance with ASTM E709.

END OF SECTION

SECTION 05 2100 - STEEL JOIST FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Open web steel joists and shear stud connectors, with bridging, attached seats and anchors.

B. Loose bearing members, such as plates or angles, and anchor bolts for site placement.

C. Supplementary framing for floor and roof openings greater than 18 inches (450 mm).

1.02 RELATED REQUIREMENTS

A. Section 05 1200 - Structural Steel Framing: Superstructure framing.

B. Section 05 3100 - Steel Decking: Bearing plates and angles.

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

B. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished; 2024.

C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

D. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.

E. ASTM E94/E94M - Standard Guide for Radiographic Examination Using Industrial Radiographic Film; 2017.

F. ASTM E164 - Standard Practice for Contact Ultrasonic Testing of Weldments; 2024.

G. ASTM E165/E165M - Standard Practice for Liquid Penetrant Testing for General Industry; 2023.

H. ASTM E709 - Standard Guide for Magnetic Particle Testing; 2021.

I. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025.

J. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172; 2019.

K. RCSC (HSBOLT) - Specification for Structural Joints Using High-Strength Bolts; Research Council on Structural Connections; 2020.

L. SJI 100 - Standard Specifications for K-Series, LH-Series, and DLH-Series Open Web Steel Joists, and for Joist Girders; 2020.

M. SJI Technical Digest No. 9 - Handling and Erection of Steel Joists and Joist Girders; 2008.

N. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.

O. SSPC-SP 2 - Hand Tool Cleaning; 2024.

1.04 SUBMITTALS

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

B. Shop Drawings: Indicate standard designations, joist coding, configurations, sizes, spacings, cambers, locations of joists, joist leg extensions, bridging, connections, and attachments.

1.05 QUALITY ASSURANCE

A. Design connections not detailed on drawings 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. Perform Work, including that for headers and other supplementary framing, in accordance with SJI 100 Standard Specifications Load Tables and SJI Technical Digest No. 9.

C. Fabricator Qualifications: A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel in accordance with IAS AC172.

D. Erector Qualifications: Company specializing in performing the work of this section with minimum five years experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Transport, handle, store, and protect products to SJI requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Steel Joists:
   1. Canam Group Inc: www.canam-steeljoists.ws
   2. New Millennium Building Systems: www.newmill.com.
   3. Nucor-Vulcraft Group: www.vulcraft.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Open Web Joists: SJI Type K Joists:
   1. Provide bottom chord extensions as indicated.
   2. Finish: Shop primed.

B. Anchor Bolts, Nuts and Washers: ASTM A307 hot-dip galvanized per ASTM A153/A153M Class C.

C. Shear Stud Connectors: Made from ASTM A108 Grade 1015 bars.

D. Structural Steel For Supplementary Framing and Joist Leg Extensions: ASTM A36/A36M.

E. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

F. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.03 FINISH

A. Shop prime joists as specified.
   1. Do not prime surfaces that will be fireproofed, field welded, or in contact with concrete.

B. Prepare surfaces to be finished in accordance with SSPC-SP 2.

2.04 SOURCE QUALITY CONTROL

A. Provide shop testing of steel components as follows:

B. High-Strength Bolts: Provide testing and verification of shop-bolted connections in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts", testing at least 10 percent of bolts at each connection.

C. Welded Connections: Visually inspect all shop-welded connections and test at least 10 percent of welds using one of the following:
   1. Radiographic testing performed in accordance with ASTM E94/E94M.
   2. Ultrasonic testing performed in accordance with ASTM E164.
   3. Liquid penetrant inspection performed in accordance with ASTM E165/E165M.
   4. Magnetic particle inspection performed in accordance with ASTM E709.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions prior to beginning work.

3.02 ERECTION

A. Erect joists with correct bearing on supports.

B. Allow for erection loads. Provide sufficient temporary bracing to maintain framing safe, plumb, and in true alignment.

C. Coordinate the placement of anchors for securing loose bearing members furnished as part of the work of this section.

D. After joist alignment and installation of framing, field weld joist seats to steel bearing surfaces.

E. Position and field weld joist chord extensions and wall attachments as detailed.

F. Install supplementary framing for floor and roof openings greater than 18 inches (450 mm).

G. Do not permit erection of decking until joists are braced, bridged, and secured or until completion of erection and installation of permanent bridging and bracing.

H. Do not field cut or alter structural members without approval of joist manufacturer.

I. After erection, prime welds, damaged shop primer, damaged galvanizing, and surfaces not shop primed , except surfaces specified not to be primed.

3.03 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch (6 mm).

B. Maximum Offset From True Alignment: 1/4 inch (6 mm).

3.04 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - Quality Requirements.

B. High-Strength Bolts: Provide testing and verification of field-bolted connections in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts", testing at least 10 percent of bolts at each connection.

C. Welded Connections: Visually inspect all field-welded connections and test at least 10 percent of welds using one of the following:

1. Radiographic testing performed in accordance with ASTM E94/E94M.
2. Ultrasonic testing performed in accordance with ASTM E164.
3. Liquid penetrant inspection performed in accordance with ASTM E165/E165M.
4. Magnetic particle inspection performed in accordance with ASTM E709.

END OF SECTION

SECTION 05 3100 - STEEL DECKING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Acoustical roof deck.
B. Roof deck.
C. Composite floor deck.
D. Metal form deck.
E. Supplementary framing for openings up to and including 18 inches (450 mm).
F. Bearing plates and angles.
G. Acoustical insulation in roof deck flutes.

1.02 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; 2017.
C. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2016.
D. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025.
E. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2018, with Errata (2022).
F. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172; 2019.
G. SDI (DM) - Publication No.30, Design Manual for Composite Decks, Form Decks, and Roof Decks; 2007.
H. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittals procedures.
B. Product Data: Provide deck profile characteristics, dimensions, structural properties, and finishes.
C. Shop Drawings: Indicate deck plan, support locations, projections, openings, reinforcement, pertinent details, and accessories.
D. Certificates: Certify that products furnished meet or exceed specified requirements.

1.04 QUALITY ASSURANCE

A. Design deck layout, spans, fastening, and joints 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. Fabricator Qualifications: A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel in accordance with IAS AC172.
C. Installer Qualifications: Company specializing in performing the work of this Section with minimum five years of experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Cut plastic wrap to encourage ventilation.
B. Separate sheets and store deck on dry wood sleepers; slope for positive drainage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Steel Deck:
   1. Canam Steel Corporation: www.canam-steeljoists.ws.
   2. New Millennium Building Systems: www.newmill.com.
   3. Nucor-Vulcraft Group: www.vulcraft.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 STEEL DECK

A. All Deck Types: Select and design metal deck in accordance with SDI Design Manual.
   1. Calculate to structural working stress design and structural properties specified.
   2. Maximum Vertical Deflection of Roof Deck: 1/240 of span.

B. Acoustical Roof Deck: Non-composite type, steel sheet with plain vertical flute faces perforated with 1/8 inch (3 mm) diameter holes staggered 3/8 inch (10 mm) on center:
   1. Ungalvanized Steel Sheet: ASTM A1008/A1008M, Designation SS, Grade 33, Type 1.
   2. Primer: Shop coat of manufacturer's standard primer paint over cleaned and phosphatized substrate.
   3. Minimum Base Metal Thickness: 20 gauge, 0.0359 inch (0.91 mm).
   4. Nominal Height: 3 inch.
   5. Side Joints: Lapped, welded.
   6. End Joints: Lapped, welded.

C. Roof Deck: Non-composite type, fluted steel sheet:
   1. Ungalvanized Steel Sheet: ASTM A1008/A1008M, Designation SS, Grade 33, Type 1.
   2. Primer: Shop coat of manufacturer's standard primer paint over cleaned and phosphatized substrate.
   3. Nominal Height: 1-1/2 inch (38 mm).
   4. Side Joints: Lock seam.
   5. End Joints: Lapped, welded.

D. Composite Floor Deck: Fluted steel sheet embossed to interlock with concrete:
   1. Basis of Design: 3 inch VLI as manufactured by Vulcraft: www.Nucor Vulcraft: www.vulcraft.com.
   2. Substitutions: See Section 01 6000-Product Requirements.
   3. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 33/230, with G90/Z275 galvanized coating.
   4. Primer: Shop coat of manufacturer's standard primer paint over cleaned and phosphatized substrate.
   5. Minimum Base Metal Thickness: 20 gauge, 0.0359 inch (0.91 mm).
   6. Nominal Height: 3 inches.
   7. Side Joints: Lock seam.
   8. End Joints: Lapped, welded.

E. Metal Form Deck: Corrugated sheet steel:
   1. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 33/230, with G90/Z275 galvanized coating.
   2. Provide form deck size, gauge, depth and profile as shown and noted on drawings.

2.03 ACCESSORY MATERIALS

A. Bearing Plates and Angles: ASTM A36/A36M steel, unfinished.

B. Welding Materials: AWS D1.1/D1.1M.

C. Weld Washers: Mild steel, uncoated, 3/4 inch (19 mm) outside diameter, 1/8 inch (3 mm) thick.

D. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

E. Flute Closures: Closed cell foam rubber, 1 inch (25 mm) thick; profiled to fit tight to the deck.

F. Acoustical Insulation: Glass fiber type, minimum 1.1 lb/cu ft (18 kg/cu m) density; profiled to suit deck.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions prior to beginning work.

3.02 INSTALLATION

A. Erect metal deck in accordance with SDI Design Manual and manufacturer's instructions. Align and level.

B. On concrete and masonry surfaces provide minimum 4 inch (100 mm) bearing.

C. On steel supports provide minimum 1-1/2 inch (38 mm) bearing.

D. Fasten deck to steel support members at ends and intermediate supports at 12 inches (300 mm) on center maximum, parallel with the deck flute and at each transverse flute using methods specified.

1. Welding: Use fusion welds through weld washers.

E. Clinch lock seam side laps.

F. At welded male/female side laps weld at 18 inches (450 mm) on center maximum.

G. Weld deck in accordance with AWS D1.3/D1.3M.

H. Where deck (other than cellular deck electrical raceway) changes direction, install 6 inch (150 mm) minimum wide sheet steel cover plates, of same thickness as deck. Fusion weld 12 inches (300 mm) on center maximum.

I. At floor edges, install concrete stops upturned to top surface of slab, to contain wet concrete. Provide stops of sufficient strength to remain stationary without distortion.

J. Close openings above walls and partitions perpendicular to deck flutes with single row of foam cell closures.

K. Immediately after welding deck and other metal components in position, coat welds, burned areas, and damaged surface coating, with touch-up primer.

END OF SECTION

SECTION 05 4000 - COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Formed steel stud exterior wall framing.

B. Formed steel stud interior wall and floor framing.

1.02 REFERENCE STANDARDS

A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2016, with Supplement (2020).

B. AISI S240 - North American Standard for Cold-Formed Steel Structural Framing; 2015, with Errata (2020).

C. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

E. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2020.

F. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members; 2015.

G. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2020 (Reapproved 2024).

H. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.

1.03 SUBMITTALS

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

B. Product Data: Provide data on standard framing members; describe materials and finish, product criteria, limitations.

C. Product Data: For lateral-force resisting systems, provide product data sheets on hold-down, showing compliance with requirements.

D. Shop Drawings: Indicate component details, framed openings, bearing, anchorage, loading, welds, and type and location of fasteners, and accessories or items required of related work.

1. Describe method for securing studs to tracks and for bolted framing connections.

E. Manufacturer's Qualification statement.

1.04 QUALITY ASSURANCE

A. Designer Qualifications: Design framing system under direct supervision of a professional structural engineer experienced in designing this work and licensed in the State in which the Project is located.

B. Manufacturer Qualifications:

1. Company specializing in manufacturing the types of products specified in this section, and with minimum 3 years of documented experience.

2. Member of Steel Stud Manufacturers Association (SSMA): www.ssma.com/#sle.

C. Installer Qualifications: Company specializing in performing the work of this section with minimum three years experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Structural Framing:
   1. CEMCO: www.cemcosteel.com.
   2. ClarkDietrich: www.clarkdietrich.com.
   3. MarinoWARE: www.marinoware.com.
   4. SCAFCO Corporation: www.scafco.com.
   5. The Steel Network, Inc: www.SteelNetwork.com.
   6. Substitutions: See Section 01 6000 - Product Requirements.

B. Connectors:
   1. Same manufacturer as metal framing.
   2. ClarkDietrich: www.clarkdietrich.com.
   3. MarinoWARE: www.marinoware.com.
   4. Simpson Strong Tie: www.strongtie.com.
   5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

A. Design Requirements: Design cold-formed framing systems, components and connectors to withstand specified design loads in compliance with ICC (IBC), ASCE 7, AISI S100, and AISI S240.

2.03 MATERIALS

A. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S240.
   1. Corrosion Protection Coating Designation: CP 90 in accordance with AISI S240.

2.04 STRUCTURAL FRAMING COMPONENTS

A. Wall Studs and Track Sections (MET STUD-1): AISI S240; c-shaped studs and u-shaped track sections in stud-matching nominal width and compatible height.
   1. Thickness and Depth: As indicated on drawings.

2.05 MISCELLANEOUS CONNECTIONS

A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot-dip galvanized per ASTM A153/A153M.

B. Welding: Comply with AWS D1.1/D1.1M.

2.06 ACCESSORIES

A. Bracing, Furring, Bridging: Formed sheet steel, thickness determined for conditions encountered; finish to match framing components.

B. Galvanizing Repair: Touch up bare steel with zinc-rich paint in compliance with ASTM A780/A780M.

C. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

D. Sill Gasket on Top of Foundation Wall: 1/4 inch (6 mm) thick, plate width, closed cell plastic foam from continuous rolls.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

B. Verify field measurements and adjust installation as required.

3.02 INSTALLATION - GENERAL

A. Install structural members and connections in compliance with ASTM C1007.

3.03 INSTALLATION OF STUDS

A. Install sill gasket under sill plate of framed walls bearing on foundations; puncture gasket cleanly to fit tightly around protruding anchor bolts.

B. Construct corners using minimum of three studs. Install double studs at wall openings, door and window jambs.

C. Install load-bearing studs full length in one piece. Splicing of studs is not permitted.

D. Install load-bearing studs; brace, and reinforce to develop full strength and achieve design requirements.

E. Coordinate placement of insulation in multiple stud spaces made inaccessible after erection.

F. Install intermediate studs above and below openings to align with wall stud spacing.

G. Provide deflection allowance in stud track, directly below horizontal building framing at non-loadbearing framing.

H. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.

END OF SECTION

SECTION 05 5000 - METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Placement of metal fabrications in concrete.

B. Section 04 2000 - Unit Masonry: Placement of metal fabrications in masonry.

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2024.

C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

D. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2024.

E. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.

F. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2021.

G. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2017.

H. 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; 2023.

I. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.

J. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025.

K. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.

L. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.

M. SSPC-SP 2 - Hand Tool Cleaning; 2024.

1.04 SUBMITTALS

A. See Section 01 3000 - 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.

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/A283M.

D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.
E. Slotted Channel Framing: ASTM A653/A653M, Grade 33.
F. Slotted Channel Fittings: ASTM A1011/A1011M.
G. Bolts, Nuts, and Washers: ASTM A307, Grade A, plain.
H. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
I. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
J. 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. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
E. Furnish 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. Bollards (MET FAB-2): Steel pipe, concrete filled, crowned cap, as detailed. Provide an HDPE cover with coved top over the steel bollard. Color as selected by Architect; Size: As indicated on Civil drawings.
B. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of metal decking and masonry; prime paint finish.
C. Door Frames for Overhead Door Openings: Channel sections; prime paint finish.
D. Elevator Hoistway Divider Beams: Beam sections; prime paint finish.
E. Metal Panel (MET FAB-10): Aluminum; Alloy 3003-H14.
    1. Basis of Design: McNichols: www.mcnichols.com.
    2. Thickness: 0.125 inches (8 gauge).
    3. Hole Size: 1/4 inch round on 3/8 inch staggered centers.
    4. Open Area: 40%.
F. Weathering Steel Plate:
    1. (WTHR STL-5): Fin assembly above lobby entrance; weathering steel plate, as shown in drawings.
    2. (WTHR STL-6): Window and door surrounds; weathering steel plate, as shown on drawings.

2.04 FINISHES - STEEL

A. Prime paint steel items.
    1. Exceptions: Galvanize items to be embedded in concrete and items to be embedded in masonry.
B. Prepare surfaces to be primed in accordance with SSPC-SP2.
C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
D. Prime Painting: One coat.
E. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

2.05 FABRICATION TOLERANCES

A. Squareness: 1/8 inch (3 mm) maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch (1.5 mm).
C. Maximum Misalignment of Adjacent Members: 1/16 inch (1.5 mm).
D. Maximum Bow: 1/8 inch (3 mm) in 48 inches (1.2 m).
E. Maximum Deviation From Plane: 1/16 inch (1.5 mm) in 48 inches (1.2 m).

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.

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 , except surfaces to be in contact with concrete.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch (6 mm) per story, non-cumulative.
B. Maximum Offset From True Alignment: 1/4 inch (6 mm).
C. Maximum Out-of-Position: 1/4 inch (6 mm).

END OF SECTION

SECTION 05 5100 - METAL STAIRS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Stairs with concrete treads.
B. Structural steel stair framing and supports.
C. Handrails and guards.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete fill in stair pans; mesh reinforcement for landings.
B. Section 03 3000 - Cast-in-Place Concrete: Placement of metal anchors in concrete.
C. Section 04 2000 - Unit Masonry: Placement of metal fabrications in masonry.

1.03 REFERENCE STANDARDS

A. AISC 201 - AISC Certification Program for Structural Steel Fabricators, Standard for Steel Building Structures; 2006.
B. ASTM A6/A6M - Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling; 2024b.
C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
D. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2024.
E. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
F. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2024.
G. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2023.
H. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2021.
I. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2016.
J. 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; 2023.
K. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi, 144 ksi, and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2025.
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-SP 2 - Hand Tool Cleaning; 2024.

1.04 SUBMITTALS

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

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.

1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
2. Include the design engineer's seal and signature on each sheet of shop drawings.

1.05 QUALITY ASSURANCE

A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located, or personnel under direct supervision of such an engineer.

B. Fabricator Qualifications:

1. A qualified steel fabricator that is certified by the American Institute for Steel Construction (AISC) under AISC 201.

PART 2 PRODUCTS

2.01 METAL STAIRS - GENERAL

A. Metal Stairs: Provide stairs of the design specified, complete with landing platforms, vertical and horizontal supports, railings, and guards, fabricated accurately for anchorage to each other and to building structure.

1. Regulatory Requirements: Provide stairs and railings that comply with most stringent requirements of local, state, and federal regulations; where requirements of Contract Documents exceed those of regulations, comply with Contract Documents.
2. Handrails: Comply with applicable accessibility requirements of ADA Standards.
3. Structural Design: Provide complete stair and railing assemblies that comply with the applicable local code.
4. Dimensions: As indicated on drawings.
5. Shop assemble components; disassemble into largest practical sections suitable for transport and access to site.
6. No sharp or rough areas on exposed travel surfaces and surfaces accessible to touch.
7. Separate dissimilar metals using paint or permanent tape.

B. Metal Jointing and Finish Quality Levels:

1. Architectural: All joints as inconspicuous as possible, whether welded or mechanical.
   a. Welded Joints: Continuously welded and ground smooth and flush.
   b. Mechanical Joints: Butted tight, flush, and hairline; concealed fastenings only.
   c. Exposed Edges and Corners: Eased to small uniform radius.
   d. Metal Surfaces to be Painted: Sanded or ground smooth, suitable for highest quality gloss finish.

C. Fasteners: Same material or compatible with materials being fastened; type consistent with design and specified quality level.

D. Anchors and Related Components: Same material and finish as item to be anchored, except where specifically indicated otherwise; provide all anchors and fasteners required.

2.02 METAL STAIRS WITH CONCRETE TREADS

A. Jointing and Finish Quality Level: Architectural, as defined above.

B. Risers: Closed.

C. Treads: Metal pan with field-installed concrete fill.

1. Concrete Depth: 1-1/2 inches (38 mm), minimum.
2. Tread Pan Material: Steel sheet.
3. Tread Pan Thickness: As required by design; 14 gauge, 0.075 inch (1.9 mm) minimum.
4. Concrete Reinforcement: Welded wire mesh.
5. Concrete Finish: For resilient floor covering.

D. Risers: Same material and thickness as tread pans.

1. Nosing Depth: Not more than 1-1/2 inch (38 mm) overhang.
2. Nosing Return: Flush with top of concrete fill, not more than 1/2 inch (12 mm) wide.

E. Stringers: Steel plate.

1. Stringer Depth: 12 inches (305 mm).

F. Landings: Similar construction, using corrugated steel decking, supported and reinforced as required to achieve design load capacity.

G. Railings: Steel mesh railings.

H. Finish: Shop- or factory-prime painted.

I. Under Side of Stair: Exposed to view, to be finished same as specified for other exposed to view surfaces.

2.03 HANDRAILS AND GUARDS

A. Wall-Mounted Rails: As indicated on drawings.

1. Outside Diameter: 1-1/4 inch (32 mm), minimum, to 1-1/2 inches (38 mm), maximum.

B. Guards:

1. Top Rails: As indicated on drawings.
2. Infill at Picket Railings: Vertical pickets.
    a. Horizontal Spacing: Maximum 4 inches (100 mm) on center.
    b. Material: Solid steel bar.
    c. Shape: Square.
    d. Size: 3/4 inch (19 mm) square.
    e. Top Mounting: Welded to underside of top rail.
    f. Bottom Mounting: Welded to top surface of stringer.
3. Infill at Mesh Railings: As indicated in section 05 5000 - Metal Fabrications (MET FAB-10).
4. End and Intermediate Posts: Same material and size as top rails.
    a. Horizontal Spacing: As indicated on drawings.
    b. Mounting: Welded to top surface of stringer.

2.04 MATERIALS

A. Steel Sections: ASTM A36/A36M.

B. Steel Tubing: ASTM A500/A500M or ASTM A501/A501M structural tubing, round and shapes as indicated.

C. Steel Plates: ASTM A6/A6M or ASTM A283/A283M.

D. Pipe: ASTM A53/A53M Grade B Schedule 40, black finish.

E. Ungalvanized Steel Sheet: Hot- or cold-rolled, except use cold-rolled where finished work will be exposed to view.
   1. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Designation CS (commercial steel).
   2. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Designation CS (commercial steel).

F. Concrete Fill: See Section 03 3000.

2.05 ACCESSORIES

A. Steel Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, and galvanized to ASTM A153/A153M where connecting galvanized components.

B. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

C. Shop and Touch-Up Primer: SSPC-Paint 15, and comply with VOC limitations of authorities having jurisdiction.

2.06 SHOP FINISHING

A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

B. Do not prime surfaces in direct contact with concrete or where field welding is required.

C. Prime Painting: Use specified shop- and touch-up primer.
   1. Preparation of Steel: In accordance with SSPC-SP 2 Hand Tool Cleaning.
   2. Number of Coats: One.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. When field welding is required, clean and strip primed steel items to bare metal.

B. Supply items required to be cast into concrete and embedded in masonry with setting templates.

3.03 INSTALLATION

A. Install components plumb and level, accurately fitted, free from distortion or defects.

B. Provide anchors, plates, angles, and hangers required for connecting stairs to structure.

C. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

D. Provide welded field joints where specifically indicated on drawings. Perform field welding in accordance with AWS D1.1/D1.1M.

E. Other field joints may be either welded or bolted provided the result complies with the limitations specified for jointing quality levels.

F. Obtain approval prior to site cutting or creating adjustments not scheduled.

G. 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 (6 mm) per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch (6 mm).

END OF SECTION

SECTION 05 5133 - METAL LADDERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shop-fabricated metal ladders.

B. Prefabricated ladders.

C. Prefabricated ship ladders.

1.02 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).

B. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements; 2008 (Reaffirmed 2018).

C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

D. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2021.

E. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

F. ASTM B210/B210M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes; 2019a.

G. ASTM B211/B211M - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire; 2019.

H. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.

I. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025.

J. AWS D1.2/D1.2M - Structural Welding Code - Aluminum; 2014, with Errata (2020).

K. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.

1.03 SUBMITTALS

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

B. Shop Drawings:

1. Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
2. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

A. Steel Sections: ASTM A36/A36M.

B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.

C. Mechanical Fasteners: Same material or compatible with materials being fastened; type consistent with design and specified quality level.

D. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

E. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.02 MATERIALS - ALUMINUM

A. Extruded Aluminum: ASTM B211/B211M, 6063 alloy, T6 temper.

B. Sheet Aluminum: ASTM B209/B209M, 5052 alloy, H32 or H22 temper.

C. Aluminum-Alloy Drawn Seamless Tubes: ASTM B210/B210M, 6061 alloy, T6 temper.

D. Aluminum-Alloy Bars: ASTM B211/B211M, 6061 alloy, T6 temper.

E. Bolts, Nuts, and Washers: Stainless steel.

F. Welding Materials: AWS D1.2/D1.2M; type required for materials being welded.

2.03 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.

2.04 PREFABRICATED LADDERS

A. Prefabricated Ladder (LADDER-1): Welded metal unit complying with ANSI A14.3; factory fabricated to greatest degree practical and in the largest components possible.

1. Components: Manufacturer's standard rails, rungs, treads, handrails. returns, platforms and safety devices complying with the requirements of the MATERIALS article of this section.
2. Materials: Aluminum; 6063 alloy, T52 temper.
3. Finish: Mill finish aluminum.
4. Manufacturers:
    a. O'Keeffe's Inc: Model 502: www.okeeffes.com.
    b. Substitutions: See Section 01 6000 - Product Requirements.

B. Prefabricated Ship Ladder (SHIP LADDER-1): Welded metal unit complying with ANSI A14.3; factory fabricated to greatest degree practical and in the largest components possible.

1. Components: Manufacturer's standard rails, rungs, treads, handrails. returns, platforms and safety devices complying with the requirements of the MATERIALS article of this section.
2. Materials: Aluminum; ASTM B211/B211M 6063 alloy, T52 temper.
3. Incline: 60 degrees.
4. Treads: Minimum 6 inches deep and 18 inches wide.
5. Risers: Maximum 9-1/2 inches high.
6. Handrail: Between 30 and 34 inches high as measured from tread nosing.
7. Finish: Mill finish aluminum.
8. Manufacturers:
    a. O'Keeffe's Inc; Model 523A: www.okeeffes.com.
    b. Substitutions: See Section 01 6000 - Product Requirements.

2.05 FINISHES - ALUMINUM

A. Exterior Aluminum Surfaces: Class I natural anodized.

B. Interior Aluminum Surfaces: Class I natural anodized.

C. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils (0.018 mm) thick.

2.06 FABRICATION TOLERANCES

A. Squareness: 1/8 inch (3 mm) maximum difference in diagonal measurements.
B. Maximum Offset Between Faces: 1/16 inch (1.5 mm).
C. Maximum Misalignment of Adjacent Members: 1/16 inch (1.5 mm).
D. Maximum Bow: 1/8 inch (3 mm) in 48 inches (1.2 m).
E. Maximum Deviation From Plane: 1/16 inch (1.5 mm) in 48 inches (1.2 m).

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.

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 , except surfaces to be in contact with concrete.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch (6 mm) per story, non-cumulative.
B. Maximum Offset From True Alignment: 1/4 inch (6 mm).
C. Maximum Out-of-Position: 1/4 inch (6 mm).

END OF SECTION

SECTION 05 5213 - PIPE AND TUBE RAILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Free-standing railings at steps.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Placement of anchors in concrete.

1.03 REFERENCE STANDARDS

A. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2024.

B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

C. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2020.

D. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025.

1.04 SUBMITTALS

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

B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

PART 2 PRODUCTS

2.01 RAILINGS - GENERAL REQUIREMENTS

A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of applicable local code.

B. Allow for expansion and contraction of members and building movement without damage to connections or members.

C. Dimensions: See drawings for configurations and heights.

D. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.

E. Provide slip-on non-weld mechanical fittings to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.

2.02 STEEL RAILING SYSTEM

A. Steel Pipe: ASTM A53/A53M Grade B Schedule 80, galvanized finish.

B. Non-Weld Mechanical Fittings: Slip-on, galvanized malleable iron castings, for Schedule 40 pipe, with flush setscrews for tightening by standard hex wrench, no bolts or screw fasteners.

C. Welding Fittings: Factory- or shop-welded from matching pipe or tube; seams continuously welded; joints and seams ground smooth.

D. Exposed Fasteners: No exposed bolts or screws.

E. Galvanizing: In accordance with requirements of ASTM A123/A123M.

F. Non-Penetrating Railing System (S-RAIL-1): Freestanding egress barrier system on roof: Pipe railings, uprights, bases, accessories, fittings:
   1. Basis of Design: Safety Rail Company SRC360 Mobile Safety Rail System: www.safetyrailcompany.com.
   2. Railings: 1-5/8 inch (41 mm) O.D. hot rolled tubing, free of sharp edges and sna
   3. Mounting Bases: Class 30 gray iron material cast with (4) receiver posts. Rubber pads on bottom.
   4. Receiver Posts: Positive locking system into receiver holes.
   5. Securing Pins: 1010 carbon steel, zinc plated and yellow chromate dipped.
   6. Finish: Hot dip galvanized.

2.03 FABRICATION

A. Accurately form components to suit specific project conditions and for proper connection to building structure.
B. Fit and shop assemble components in largest practical sizes for delivery to site.
C. Fabricate components with joints tightly fitted and secured.
D. Welded Joints:
   1. Exterior Components: Continuously seal joined pieces by intermittent welds and plastic filler. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.
   2. Interior Components: Continuously seal joined pieces by intermittent welds and plastic filler.
   3. 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.
E. Weld connections that cannot be shop welded due to size limitations.
   1. Weld in accordance with AWS D1.1/D1.1M.
   2. Match shop welding and bolting.
   3. Clean welds, bolted connections, and abraded areas.
   4. Touch up shop primer and factory-applied finishes.
   5. Repair galvanizing with galvanizing repair paint per ASTM A780/A780M.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. Supply items required to be cast into concrete with setting templates, for installation as work of other sections.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.
C. Anchor railings securely to structure.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch (6 mm) per floor level, non-cumulative.
B. Maximum Offset From True Alignment: 1/4 inch (6 mm).

C. Maximum Out-of-Position: 1/4 inch (6 mm).

END OF SECTION

SECTION 06 1000 - ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Structural dimension lumber framing.
B. Rough opening framing for doors, windows, and roof openings.
C. Sheathing.
D. Roof-mounted curbs.
E. Preservative treated wood materials.
F. Fire retardant treated wood materials.
G. Miscellaneous framing and sheathing.
H. Concealed wood blocking, nailers, and supports.

1.02 RELATED REQUIREMENTS

A. Section 07 6200 - Sheet Metal Flashing and Trim: Sill flashings.
B. Section 09 2116 - Gypsum Board Assemblies: Gypsum-based sheathing.

1.03 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
B. ASTM D2898 - Standard Test Methods for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing; 2010 (Reapproved 2017).
C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018.
D. AWPA U1 - Use Category System: User Specification for Treated Wood; 2017.
E. PS 1 - Structural Plywood; 2023.
F. PS 2 - Performance Standard for Wood Structural Panels; 2018.
G. PS 20 - American Softwood Lumber Standard; 2025.
H. SPIB (GR) - Grading Rules; 2014.

1.04 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.
B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, and installation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
    1. If no species is specified, provide species graded by the agency specified; if no grading agency is specified, provide lumber graded by grading agency meeting the specified requirements.
    2. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee at www.alsc.org, and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
B. Wood sourced from a sustainably harvested location. Submit any documentation available.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Grading Agency: Southern Pine Inspection Bureau, Inc; SPIB (GR).

B. Sizes: Nominal sizes as indicated on drawings, S4S.

C. Moisture Content: S-dry or MC19.

D. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring (WD BLKG):

1. Lumber: S4S, No. 2 or Standard Grade.
2. Boards: Standard or No. 3.

2.03 CONSTRUCTION PANELS

A. Wall Sheathing: Plywood, PS 1, Grade C-D, Exposure I.

1. (WD SHTG-30): 1/2 inch.

B. Other Applications:

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

2.04 ACCESSORIES

A. Fasteners and Anchors:

1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.

B. Sill Gasket on Top of Foundation Wall: 3/8 inch (9.5 mm) thick, closed-cell plastic foam.

1. Width: 3-1/2 inches (89 mm).
2. Ultraviolet (UV) and Weathering Resistance: Approved in writing by manufacturer for up to 30 days of weather exposure.

C. Sill Flashing: See Section 07 6200.

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. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
2. 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:

1. Exterior Type: AWPA U1, Category UCFB, Commodity Specification H, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes both before and after accelerated weathering test performed in accordance with ASTM D2898.
   a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
   b. Do not use treated wood in direct contact with the ground.
2. Interior Type A: AWPA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum

flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.

a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
b. Treat rough carpentry items as indicated .
c. Do not use treated wood in applications exposed to weather or where the wood may become wet.

C. Preservative Treatment:
1. Products:
2. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A.
a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
3. Preservative Pressure Treatment of Plywood Above Grade: AWPA U1, Use Category UC2 and UC3B, Commodity Specification F.
a. Kiln dry plywood after treatment to maximum moisture content of 19 percent.
4. Preservative Pressure Treatment of Lumber in Contact with Soil: AWPA U1, Use Category UC4A, Commodity Specification A.
a. Preservative for Field Application to Cut Surfaces: As recommended by manufacturer of factory treatment chemicals for brush-application in the field.
b. Restrictions: Do not use lumber or plywood treated with chromated copper arsenate (CCA) in exposed exterior applications subject to leaching.

PART 3 EXECUTION

3.01 PREPARATION

A. Where wood framing bears on cementitious foundations, install full width sill flashing continuous over top of foundation, lap ends of flashing minimum of 4 inches (100 mm) and seal.
B. Install sill gasket under sill plate of framed walls bearing on foundations; puncture gasket cleanly to fit tightly around protruding anchor bolts.

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 BLOCKING, NAILERS, AND SUPPORTS

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

3.04 INSTALLATION OF CONSTRUCTION PANELS

A. Wall Sheathing: Secure with long dimension in the most efficient direction to wall studs, with ends over firm bearing and staggered, using nails or screws.

3.05 CLEANING

A. Waste Disposal: See Section 01 7419 - Construction Waste Management and Disposal.
   1. Comply with applicable regulations.
   2. Do not burn scrap on project site.
   3. Do not burn scraps that have been pressure treated.
   4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or "waste-to-energy" facilities.

B. Do not leave wood, shavings, sawdust, etc. on the ground or buried in fill.

C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

SECTION 06 4100 - ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Specially fabricated cabinet units.

B. Hardware.

1.02 RELATED REQUIREMENTS

A. Section 12 3600 - Countertops.

1.03 REFERENCE STANDARDS

A. ANSI A208.1 - American National Standard for Particleboard; 2022.

B. BHMA A156.9 - American National Standard for Cabinet Hardware; 2015.

C. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

1.04 SUBMITTALS

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

B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.

1. Scale of Drawings: 1-1/2 inch to 1 foot (125 mm to 1 m), minimum.

C. Product Data: Provide data for hardware accessories.

D. Samples: Submit actual samples of architectural cabinet construction, minimum 12 inches (300 mm) square, illustrating proposed cabinet substrate and finish.

1.05 QUALITY ASSURANCE

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

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect units from moisture damage.

1.07 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 CABINETS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS), unless noted otherwise.

B. Cabinets (PLAM-#):

1. Basis of Design: See drawings for product information.
2. Finish - Exposed Exterior Surfaces: Decorative laminate.
3. Finish - Exposed Interior Surfaces: Decorative laminate.
4. Finish - Semi-Exposed Surfaces: Decorative laminate
5. Finish - Concealed Surfaces: Manufacturer's option.
6. Door and Drawer Front Edge Profiles: Square edge with thick applied band.
7. Casework Construction Type: Type A - Frameless.

8. Interface Style for Cabinet and Door: Style 1 - Overlay; flush overlay.
9. Layout for Cabinet and Door Fronts: Flush panel.
10. Adjustable Shelf Loading: 40 psf (19.5 gm/sq cm).
    a. Deflection: L/144.

2.02 WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.
B. Wood sourced from a sustainably harvested location. Submit any documentation available.
C. Provide composite wood containing no added formaldehyde. See Section 01 6116.

2.03 PANEL CORE MATERIALS

A. Particleboard: Composite panel composed of cellulosic particles, additives, and bonding system; comply with ANSI A208.1.
    1. Grade: M-2; moisture resistance: MR10.

2.04 THERMALLY FUSED LAMINATE PANELS

A. Thermally Fused Laminate (TFL): Melamine-resin-saturated decorative papers; for fusion to composite wood substrates under heat and pressure.
    1. Panel Core Substrate: Particleboard.

2.05 LAMINATE MATERIALS

A. Manufacturers:
    1. Formica Corporation: www.formica.com.
    2. Panolam Industries International, Inc: www.panolam.com/#sle.
    3. Wilsonart LLC: www.wilsonart.com/#sle.
    4. Substitutions: See Section 01 6000 - Product Requirements.
B. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.
C. Provide specific types as follows:
    1. Horizontal Surfaces: HGS, 0.048 inch (1.22 mm) nominal thickness.
    2. Vertical Surfaces: VGS, 0.028 inch (0.71 mm) nominal thickness.
    3. Cabinet Liner: CLS, 0.020 inch (0.51 mm) nominal thickness.
    4. Laminate Backer: BKL, 0.020 inch (0.51 mm) nominal thickness, undecorated; for application to concealed backside of panels faced with high pressure decorative laminate.

2.06 COUNTERTOPS

A. Countertops: See Section 12 3600.

2.07 ACCESSORIES

A. Adhesive: Type recommended by fabricator to suit application.
B. Plastic Edge Banding: Extruded 3 mm PVC, flat shaped; smooth finish; of width to match component thickness.
    1. Color: As selected by Architect from manufacturer's standard range.
C. Fasteners: Size and type to suit application.
D. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.
E. Grommets: Standard plastic grommets for cut-outs, in color to match adjacent surface.

1. Provide one grommet for every 5 linear feet of countertop (excluding toilet rooms), unless noted otherwise. Coordinate locations with Architect/Owner.

2.08 HARDWARE

A. Cabinet Hardware: Comply with BHMA A156.9 for hardware types and grades indicated below:
   1. Hardware Types: As indicated on drawings.
   2. Product Grade: As required by specified woodworking quality grade.

B. Adjustable Shelf Supports: Standard side-mounted system using recessed metal shelf standards or multiple holes for pin supports and coordinated self rests, polished chrome finish, for nominal 1 inch (25 mm) spacing adjustments.

C. Drawer and Door Pulls: As indicated on drawings.

D. Drawer Slides:
   1. Type: Full extension with overtravel.
   2. Static Load Capacity: Heavy Duty grade.
   3. Mounting: Side mounted.
   4. Stops: Integral type.
   5. Features: Provide self closing/stay closed type.
   6. Manufacturers:
      a. Accuride International, Inc: www.accuride.com.
      b. Grass America Inc: www.grassusa.com.
      c. Hettich America, LP: www.hettich.com.
      d. Knape & Vogt Manufacturing Company: www.knapeandvogt.com.
      e. Substitutions: See Section 01 6000 - Product Requirements.

E. Hinges: European style concealed self-closing type, steel with nickel-plated finish.
   1. Manufacturers:
      a. Blum, Inc: www.blum.com/#sle.
      b. Grass America Inc: www.grassusa.com/#sle.
      c. Hardware Resources: www.hardwareresources.com.
      d. Hettich America, LP: www.hettich.com/sle.
      e. Substitutions: See Section 01 6000 - Product Requirements.

2.09 FABRICATION

A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.

B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.

C. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs. (Locate counter butt joints minimum 600 mm from sink cut-outs.)
   1. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.

D. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Prime paint cut edges.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify location and sizes of utility rough-in associated with work of this section.

3.02 INSTALLATION

A. Install work in accordance with AWI/AWMAC/WI (AWS) requirements for grade indicated.

B. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.

C. Use fixture attachments in concealed locations for wall mounted components.

D. Use concealed joint fasteners to align and secure adjoining cabinet units.

E. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch (0.79 mm). Do not use additional overlay trim for this purpose.

F. Secure cabinets to floor using appropriate angles and anchorages.

G. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

3.03 ADJUSTING

A. Adjust installed work.

B. Adjust moving or operating parts to function smoothly and correctly.

3.04 CLEANING

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

END OF SECTION

SECTION 06 8316 - FIBERGLASS REINFORCED PANELING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fiberglass reinforced plastic panels.

B. Trim.

1.02 REFERENCE STANDARDS

A. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.

B. ASTM D5319 - Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels; 2022.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018.

D. FDA Food Code - Chapter 6 - Physical Facilities; Current Edition.

E. FM 4880 - Examination Standard for Class 1 Fire Rating of Building Panels or Interior Finish Materials; 2022.

1.03 SUBMITTALS

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

B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

C. Samples: Submit two samples 6 by 6 inch (150 by 150 mm) in size illustrating material and surface design of panels.

1.04 DELIVERY, STORAGE, AND HANDLING

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

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fiberglass Reinforced Plastic Panels:

1. Crane Composites, Inc; Glasbord: www.cranecomposites.com.
2. Marlite, Inc; Standard FRP: www.marlite.com.
3. Nudo Products, Inc; FiberLite FRP: www.nudo.com.
4. Panolam Industries International, Inc: www.panolam.com.
5. WolfGordon: www.wolfgordon.com.
6. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PANEL SYSTEMS

A. Wall Panels (FRP-#):

1. Basis of Design: As indicated on drawings.
2. Attachment Method: Adhesive only with trim and sealant in joints.

2.03 MATERIALS

A. Panels: Fiberglass reinforced plastic (FRP), complying with ASTM D5319.

1. Surface Burning Characteristics: Maximum flame spread index of 25 and smoke developed index of 450; when system tested in accordance with ASTM E84.

2. Class 1 fire rated when tested in accordance with FM 4880.
3. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
4. Surface Characteristics and Cleanability: Provide products that are smooth, durable, and easily cleanable, in compliance with FDA Food Code, Chapter 6 - Physical Facilities.

B. Trim: Aluminum; clear anodized.

C. Adhesive: Type recommended by panel manufacturer.

D. Sealant: Type recommended by panel manufacturer; color matching panel.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions and substrate flatness before starting work.

B. Verify that substrate conditions are ready to receive the work of this section.

3.02 INSTALLATION - WALLS

A. Install panels in accordance with manufacturer's instructions.

B. Cut and drill panels with carbide tipped saw blades, drill bits, or snips.

C. Apply adhesive to the back side of the panel using trowel as recommended by adhesive manufacturer.

D. Apply panels to wall with seams plumb and pattern aligned with adjoining panels.

E. Install panels with manufacturer's recommended gap for panel field and corner joints.

F. Place trim on panel before fastening edges, as required.

G. Fill channels in trim with sealant before attaching to panel.

H. Install trim with adhesive and screws or nails, as required.

I. Seal gaps at floor, ceiling, and between panels with applicable sealant to prevent moisture intrusion.

J. Remove excess sealant after paneling is installed and prior to curing.

END OF SECTION

SECTION 07 1300 - SHEET WATERPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Self-adhered modified bituminous sheet membrane.

B. Self-adhered HDPE sheet membrane.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete substrate.

B. Section 07 2100 - Thermal Insulation: Insulation used for protective cover.

1.03 REFERENCE STANDARDS

A. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2016 (Reapproved 2021).

B. ASTM D570 - Standard Test Method for Water Absorption of Plastics; 1998 (Reapproved 2010).

C. ASTM D882 - Standard Test Method for Tensile Properties of Thin Plastic Sheeting; 2018.

D. ASTM D903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds; 1998 (Reapproved 2025).

E. ASTM D1876 - Standard Test Method for Peel Resistance of Adhesives (T-Peel Test); 2008 (Reapproved 2023).

F. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2021.

G. ASTM D5295/D5295M - Standard Guide for Preparation of Concrete Surfaces for Adhered (Bonded) Membrane Waterproofing Systems; 2018.

H. ASTM D5385/D5385M - Standard Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes; 2025.

I. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.

J. ASTM E154/E154M - Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover; 2008a (Reapproved 2025).

K. NRCA (WM) - The NRCA Waterproofing Manual; 2021.

1.04 SUBMITTALS

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

B. Product Data: Provide data for membrane, surface conditioner, flexible flashings, and joint and crack sealants.

C. Shop Drawings: Indicate special joint or termination conditions and conditions of interface with other materials.

D. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

1.06 WARRANTY

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

B. Contractor to correct defective Work within period of five years after Date of Substantial Completion; remove and replace materials concealing waterproofing at no extra cost to Owner.

C. Provide five year manufacturer warranty for waterproofing failing to resist penetration of water, except where such failures are the result of structural failures of building. Hairline cracking of concrete due to temperature change or shrinkage is not considered a structural failure.

PART 2 PRODUCTS

2.01 SHEET WATERPROOFING MATERIALS

A. Self-Adhered Modified Bituminous Sheet Membrane (WTR PRF-1):
   1. Thickness: 60 mil, 0.060 inch (1.5 mm), minimum.
   2. Tensile Strength:
      a. Film: 5,000 psi (34.57 MPa), minimum, measured in accordance with ASTM D882 and at grip-separation rate of 2 inches (50 mm) per minute.
      b. Membrane: 325 psi (2.24 MPa), minimum, measured in accordance with ASTM D412 Method A, using die C and at spindle-separation rate of 2 inches (50 mm) per minute.
   3. Elongation at Break: 300 percent, minimum, measured in accordance with ASTM D412.
   4. Water Vapor Permeance: 0.05 perm (2.9 ng/(Pa s sq m)), maximum, measured in accordance with ASTM E96/E96M.
   5. Low Temperature Flexibility: Unaffected when tested in accordance with ASTM D1970/D1970M at minus 20 degrees F (minus 29 degrees C), 180 degree bend on 1 inch (25 mm) mandrel.
      a. Provide low temperature versions of products listed below as required.
   6. Water Absorption: 0.1 percent increase in weight, maximum, measured in accordance with ASTM D570, 24 hour immersion.
   7. Hydrostatic Pressure Resistance: Membrane resists leakage for at least one hour from pressure equivalent to 200 feet (61 m) head of water applied in accordance with test method ASTM D5385/D5385M.
   8. Adhesives, Sealants, Tapes, and Accessories: As recommended by membrane manufacturer.
   9. Basis of Design Products:
      a. Henry, A Carlisle Company; MiraDRI 860/861: www.henry.com.
      b. GCP Applied Technologies; Bituthene 3000: www.gcpat.com.
      c. W. R. Meadows, Inc; MEL-ROL LOW TEMP: www.wrmeadows.com.
      d. Substitutions: See Section 01 6000 - Product Requirements.

B. Self-Adhered HDPE Sheet Membrane (WTR PRF-2): Recommended by manufacturer for placement below concrete slabs and on outside face of below grade walls before placement of concrete.
   1. Low Temperature Flexibility: Unaffected when tested in accordance with ASTM D1970/D1970M at minus 20 degrees F (minus 29 degrees C), 180 degree bend on 1 inch (25 mm) mandrel.
      a. Provide low temperature versions of products listed below as required.
   2. Hydrostatic Pressure Resistance: Membrane resists leakage for at least one hour from pressure equivalent to 231 feet (70.4 m) head of water applied in accordance with test method ASTM D5385/D5385M.
   3. Elongation at Break: 500 percent, minimum, measured in accordance with ASTM D412.
   4. Tensile Strength, Film: 3,500 psi (24 MPa), minimum, measured in accordance with ASTM D412.

5. Water Vapor Permeance: 0.01 perm (0.6 ng/(Pa s sq m)), maximum, measured in accordance with ASTM E96/E96M.
6. Lateral Water Migration Resistance: Resists pressure of 231 ft (70 m) head of water, when tested in accordance with ASTM D5385/D5385M.
7. Adhesives, Sealants, Tapes, and Accessories: As recommended by membrane manufacturer.
8. Basis of Design Products:
    a. Henry, A Carlisle Company; MiraPLY-H: www.henry.com.
    b. GCP Applied Technologies; Preprufe 300R Plus/LT: www.gcpat.com.
    c. W.R. Meadows, Inc; PRECON: www.wrmeadows.com.
    d. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ACCESSORIES

A. Sealant for Cracks and Joints In Substrates: Resilient elastomeric joint sealant compatible with substrates and waterproofing materials.

B. Protection Board: Rigid insulation; see Section 07 2100.

C. Drainage Panel (DRAIN BD-1): Drainage layer with geotextile filter fabric on earth side.
1. Also provide at locations where (INSUL-1) is not installed over (WTR PRF-1).
2. Basis of Design Products:
    a. Henry, A Carlisle Cmopany; MiraDRAIN 2000: www.carlisle-ccw.com.
    b. Grace Construction Products; Hydroduct 200: www.na.graceconstruction.com.
    c. W. R. Meadows, Inc; Mel-Drain: www.wrmeadows.com.
    d. Substitutions: See Section 01 6000 - Product Requirements.

D. Flexible Flashings: Type recommended by membrane manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions are acceptable prior to starting work.

B. Verify substrate surfaces are durable; free of matter detrimental to adhesion or application of waterproofing system.

C. Verify that items penetrating surfaces to receive waterproofing are securely installed.

3.02 PREPARATION

A. Protect adjacent surfaces from damage not designated to receive waterproofing.

B. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions; vacuum substrate clean.

C. Do not apply waterproofing to surfaces unacceptable to membrane manufacturer.

D. Fill nonmoving joints and cracks with a filler compatible with waterproofing materials.

E. Seal moving cracks with sealant and nonrigid filler, using procedures recommended by sealant and waterproofing manufacturers.

F. Surfaces for Adhesive Bonding: Apply surface conditioner at a rate recommended by manufacturer, and protect conditioner from rain or frost until dry.

G. Concrete Surfaces for Adhesive Bonding: Prepare concrete substrate in accordance with ASTM D5295/D5295M.
1. Remove substances that inhibit adhesion including form release agents, curing compounds admixtures, laitance, moisture, dust, dirt, grease and oil.

2. Repair surface defects including honeycombs, fins, tie holes, bug holes, sharp offsets, rutted cracks, ragged corners, deviations in surface plane, spalling and delaminations, as described in reference standard.
3. Remove and replace areas of defective concrete; see Section 03 3000.
4. Prepare concrete for adhesive bonded waterproofing using mechanical or chemical methods described in referenced standard.
5. Test concrete surfaces as described in referenced standards, and verify surfaces are ready to receive adhesive bonded waterproofing membrane system.

3.03 INSTALLATION - MEMBRANE

A. Install membrane waterproofing in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.
B. Roll out membrane, and minimize wrinkles and bubbles.
C. Self-Adhering Membrane: Remove release paper layer, and roll out onto substrate with a mechanical roller to provide full contact bond.
D. Overlap edges and ends, minimum 3 inches (76 mm), seal permanently waterproof by method recommended by manufacturer, and apply uniform bead of sealant to joint edge.
E. Reinforce membrane with multiple thickness of membrane material over joints, whether joints are static or dynamic.
F. Weather lap joints on sloped substrate in direction of drainage, and seal joints and seams.
G. Flexible Flashings: Seal items watertight that penetrate through waterproofing membrane with flexible flashings.
H. Seal membrane and flashings to adjoining surfaces.
    1. Install termination bar along edges.

3.04 INSTALLATION - DRAINAGE PANEL

A. Place drainage panel directly against membrane, butt joints, place to encourage drainage downward; scribe and cut boards around projections, penetrations, and interruptions.
B. Adhere protection board to substrate with compatible adhesive.

3.05 PROTECTION

A. Do not permit traffic over unprotected or uncovered membrane.

END OF SECTION

SECTION 07 2100 - THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Board insulation at cavity wall construction, perimeter foundation wall, and exterior wall behind exterior wall finish.

B. Batt insulation in exterior wall, ceiling, and roof construction.

C. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

1.02 RELATED REQUIREMENTS

A. Section 07 2600 - Vapor Retarders: Separate vapor retarder materials.

B. Section 09 2116 - Gypsum Board Assemblies: Acoustic insulation inside walls and partitions.

1.03 REFERENCE STANDARDS

A. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2024.

B. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2023.

C. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014 (Reapproved 2019).

D. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2024.

E. ASTM C726 - Standard Specification for Mineral Wool Roof Insulation Board; 2024.

F. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2025.

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018.

H. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components; 2025.

1.04 SUBMITTALS

A. See Section 01 3000 - 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 PRODUCT REQUIREMENTS

A. Products listed as Basis of Design have been selected for specific criteria. Products from other manufacturer’s listed herein, and/or substitutions will only be accepted if they meet, or exceed, the performance of the Basis of Design. Manufacturer must be able to provide documentation showing that the product meets, or exceeds, the Basis of Design.

2.02 FOAM BOARD INSULATION MATERIALS

A. Extruded Polystyrene (XPS) Board Insulation: Comply with ASTM C578 with either natural skin or cut cell surfaces.
   1. Type and Compressive Resistance: Type IV, 25 psi (173 kPa), minimum.
      a. (INSUL-1): Type IV, 25 psi. Provide drainage channels.
      b. (INSUL-2): Type IV, 25 psi.
      c. (INSUL-5): Type VII, 60 psi.
   2. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
   3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
   4. Type and Thermal Resistance, R-value (RSI-value): Type IV, 5.0 (0.88), minimum, per 1 inch (25.4 mm) thickness at 75 degrees F (24 degrees C) mean temperature.
   5. Board Edges: Square.
   6. Basis of Design: Owens Corning Corporation; FOAMULAR Extruded Polystyrene (XPS) Insulation: www.ocbuildingspec.com.
   7. Other Acceptable Products provided they meet or exceed the Basis of Design performance requirements:
      a. DuPont de Nemours, Inc; Styrofoam Brand Square Edge: building.dupont.com.
      b. Substitutions: See Section 01 6000 - Product Requirements.

2.03 MINERAL FIBER BOARD INSULATION MATERIALS

A. Mineral Wool Block, Board, or Blanket Thermal Insulation: Complying with ASTM C612 or ASTM C553.
   1. Smoke Developed Index: 0 (zero), when tested in accordance with ASTM E84.
   2. Thermal Resistance: R-value (RSI-value) of 4.2 (0.74) per inch at 75 degrees F (24 C), minimum, when tested according to ASTM C518.
   3. Maximum Density: 8 pcf (128 kg/cu m), nominal.
   4. (INSUL-27) Basis of Design: COMFORTBOARD 80 with exposed black face: www.rockwool.com.
   5. Other Acceptable Products provided they meet or exceed the Basis of Design performance requirements:
      a. Substitutions: See Section 01 6000 - Product Requirements.

2.04 ACCESSORIES

A. Sheet Vapor Retarder: See Section 07 2600.
B. Tape joints of rigid insulation in accordance with roofing and insulation manufacturers' instructions.
C. Insulation Fasteners: Appropriate for purpose intended.
D. 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 AT FOUNDATION PERIMETER

A. Install boards horizontally on foundation perimeter.
   1. Place boards to maximize adhesive contact.

2. Install in running bond pattern.
3. Butt edges and ends tightly to adjacent boards and to protrusions.

B. Extend boards over expansion joints, unbonded to foundation on one side of joint.

C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.03 BOARD INSTALLATION AT EXTERIOR WALLS

A. Install boards vertically on walls.
1. Butt edges and ends tightly to adjacent boards and protrusions.

B. Extend boards over expansion joints, unbonded to wall on one side of joint.

C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.04 BOARD INSTALLATION AT CAVITY WALLS

A. Install boards to fit snugly between wall ties.

B. Install boards horizontally on walls.

C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.05 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

SECTION 07 2119 - FOAMED-IN-PLACE INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Foamed-in-place insulation.

1.02 REFERENCE STANDARDS

A. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics; 2025.
B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018.
C. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.
D. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials; 2021a.

1.03 SUBMITTALS

A. See Section 01 3000 - 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.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with not less than three years of experience.
B. Applicator Qualifications: Company specializing in performing work of the type specified, with minimum three years experience.

1.05 FIELD CONDITIONS

A. Do not apply foam when temperature is below that specified by the manufacturer for ambient air and substrate.
B. Do not apply foam when temperature is within 5 degrees F (2.78 degrees C) of dew point.

PART 2 PRODUCTS

2.01 MATERIALS

A. Foamed-In-Place Insulation (INSUL-36): Medium-density, rigid or semi-rigid, closed cell polyurethane foam; foamed on-site, using blowing agent of water or non-ozone-depleting gas.
    1. Water Vapor Permeance: Vapor retarder; 2 perms (115 ng/(Pa s sq m)), maximum, when tested at intended thickness in accordance with ASTM E96/E96M, desiccant method.
    2. Water Absorption: Less than 2 percent by volume, maximum, when tested in accordance with ASTM D2842.
    3. Air Permeance: 0.04 cfm per square foot (0.2 L/(s/sq m)), maximum, when tested at intended thickness in accordance with ASTM E2178 at 1.57 psf (75 Pa).
    4. Closed Cell Content: At least 90 percent.
    5. Surface Burning Characteristics: Flame spread/smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.
    6. Products:

a. BASF Corporation; SPRAYTITE 81206: www.spf.basf.com/#sle.
b. Enverge; NexSeal: www.envergesprayfoam.com.
c. Henry Company; PERMAX 2.0: www.henry.com/#sle.
d. Huntsman Building Solutions; ProSeal HFO: www.huntsmanbuildingsolutions.com/#sle.
e. Johns Manville; JM Corbond IV Closed Cell Spray Polyurethane Foam: www.jm.com/#sle.
f. Rhino Linings Corporation; ThermalGuard CC2: www.rhinolinings.com/#sle.
g. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ACCESSORIES

A. Primer: As required by insulation manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify work within construction spaces or crevices is complete before insulation application.

3.02 PREPARATION

A. Mask and protect adjacent surfaces from over spray or dusting.
B. Apply primer in accordance with manufacturer's instructions.

3.03 APPLICATION

A. Apply insulation in accordance with manufacturer's instructions.
B. Apply insulation by spray method, to a uniform monolithic density without voids.
C. Patch damaged areas.
D. Where applied to voids and gaps assure space for expansion to avoid pressure on adjacent materials that may bind operable parts.

3.04 PROTECTION

A. Do not permit subsequent construction work to disturb applied insulation.

END OF SECTION

SECTION 07 2600 - VAPOR RETARDERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Vapor retarders.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Vapor retarder under concrete slabs on grade.

B. Section 07 6200 - Sheet Metal Flashing and Trim: Metal flashings installed in conjunction with vapor retarders.

1.03 DEFINITIONS

A. Vapor Retarder: Airtight barrier made of material that is relatively water vapor impermeable, to degree specified, with seams and joints sealed to adjacent surfaces.

B. Vapor Retarder Class: A measure of a material or assembly's ability to limit the amount of moisture that passes through that material or assembly. Vapor retarder class is defined using Procedure A, Desiccant Method at 73 degrees F (23 degrees C) and 50 percent Relative Humidity (RH), in accordance with ASTM E96/E96M and ICC (IBC)-2018, as follows:

1. Class I: 0.1 perm or less.
2. Class II: Greater than 0.1 perm to 1.0 perm.
3. Class III: Greater than 1.0 perm to 10 perms.

1.04 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 D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2021.

C. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.

D. ICC (IBC)-2018 - International Building Code; 2018.

E. ICC-ES AC148 - Acceptance Criteria for Flexible Flashing Materials; 2017, with Editorial Revision (2021).

1.05 SUBMITTALS

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

B. Product Data: Provide data on material characteristics, performance criteria, and limitations.

C. Shop Drawings: Provide drawings of special joint conditions.

D. Manufacturer's Installation Instructions: Indicate preparation, installation methods, and storage and handling criteria.

1.06 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by materials manufacturers before, during, and after installation.

PART 2 PRODUCTS

2.01 PRODUCT REQUIREMENTS

A. Products listed as Basis of Design have been selected for specific criteria. Products from other manufacturer's listed herein, and/or substitutions will only be accepted if they meet, or exceed, the performance of the Basis of Design. Manufacturer must be able to provide documentation showing that the product meets, or exceeds, the Basis of Design.

2.02 VAPOR RETARDERS

A. Underslab Vapor Retarders: See Section 03 3000.

B. (VPR RET-10): Contractor's option to provide a self-adhesive or liquid applied membrane as described in the following paragraphs.

C. Vapor Retarder, Self-Adhering Membranes (VPR RET-10): Rubberized asphalt bonded to aluminum foil facer.

1. Thickness: 40 mil, 0.04 inch (1.0 mm), nominal.
2. Vapor Retarder Class I: 0.1 perm (5.72 ng/(Pa s sq m)) or less, when tested in accordance with ASTM E96/E96M, Procedure A.
3. Nail Sealability: Passed nail sealability test in accordance with ASTM D1970/D1970M.
4. System Accessory Products: As recommended by membrane manufacturer.
5. Basis of Design: Henry Company; Blueskin SA LT (Low Temp): www.henry.com/#sle.
6. Other Acceptable Products provided they meet or exceed the Basis of Design performance:
    a. Carlisle Coatings and Waterproofing; Fire Resist 705FR-A: www.carlisleccw.com/#sle.
    b. GCP Applied Technologies; Perm-A-Barrier Low Temperature Wall Membrane: www.gcpat.com.
    c. W. R. Meadows, Inc; Air-Shield: www.wrmeadows.com/#sle.
    d. Substitutions: See Section 01 6000 - Product Requirements.

D. Vapor Retarder Coating (VPR RET-10): Liquid applied, resilient, ultra-violet (UV) light resistant coating; associated joint treatment.

1. Water Vapor Permeance: 1.0 perm (57 ng/(Pa s sq m)), maximum, when tested in accordance with ASTM E96/E96M.
2. VOC Content: Less than 6.68 oz/gal (50 g/L), when tested in accordance with 40 CFR 59, Subpart D - EPA Method 24.
3. Suitable for use on concrete, masonry, plywood, and gypsum sheathing.
4. Joint Preparation Treatment: Provide coating manufacturer's recommended method, either tape or reinforcing mesh saturated with coating material.
5. Joint Filler: As recommended by coating manufacturer and suitable to the substrate.
6. Basis of Design: Henry Company; Air-Bloc 16MR: www.henry.com/#sle.
7. Other Acceptable Products provided they meet or exceed the Basis of Design performance:
    a. Carlisle Coatings and Waterproofing; Fire Resist Barritech NP: www.carlisleccw.com/#sle.
    b. GCP Applied Technologies; Perm-A-Barrier NPL 10 LT: www.gcpat.com.
    c. W. R. Meadows, Inc; Air-Shield LSR: www.wrmeadows.com/#sle.
    d. Substitutions: See Section 01 6000 - Product Requirements.

2.03 ACCESSORIES

A. Sealants, Tapes, and Accessories for Sealing Vapor Retarder and Adjacent Substrates: As indicated, complying with vapor retarder manufacturer's installation instructions.

B. Sealant for Cracks and Joints in Substrates: Resilient elastomeric joint sealant compatible with substrates and vapor retarder materials.
   1. Application: Apply at 30 to 40 mil, 0.030 to 0.040 inch (0.76 to 1.02 mm), nominal thickness.
   2. All flashing materials shall be compatible with, and approved by, the membrane manufacturer.
C. Flexible Flashing: Self-adhering or mechanically-attached flashing used for wall penetrations in accordance with ICC-ES AC148 requirements.
D. Thinners and Cleaners: As recommended by vapor retarder manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and conditions comply with requirements 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 adhesives and sealants in accordance with manufacturer's installation instructions.

3.03 INSTALLATION

A. Install materials in accordance with manufacturer's installation instructions.
B. Vapor Retarders: Install continuous airtight barrier over surfaces indicated, with sealed seams and sealed joints to adjacent surfaces.
C. Apply sealants and adhesives within recommended temperature range in accordance with manufacturer's installation instructions.
D. Mechanically Fastened Sheets - Vapor Retarder On Exterior:
   1. Install sheets shingle fashion to shed water, with seams generally horizontal.
   2. Overlap seams as recommended by manufacturer, 6 inches (152 mm), minimum.
   3. Overlap at outside and inside corners as recommended by manufacturer, 12 inches (305 mm), minimum.
   4. For applications indicated to be airtight, seal seams, laps, penetrations, tears, and cuts with self-adhesive tape; use only large-headed, gasketed fasteners as recommended by manufacturer.
   5. Where stud framing rests on concrete or masonry substrate, extend lower edge of vapor retarder sheet at least 4 inches (102 mm) below bottom of framing and seal to substrate with sealant or approved mounting tape.
   6. Install vapor retarder underneath jamb flashings.
   7. At framed openings with frames having nailing flanges, extend sheet into opening and over flanges; at head of opening, seal sheet over flange and flashing.
E. Mechanically Fastened Sheets - Vapor Retarder On Interior:
   1. When insulation is installed within assembly, install vapor retarder over insulation.
   2. Anchor to wood framing using large-headed nails or staples at 12 to 18 inches (305 to 460 mm) on center along each framing member covered; cover fasteners with seam tape.
   3. Anchor to metal framing using seam tape, adhering at least one-half of tape width to metal substrate.
   4. Seal seams, laps, perimeter edges, penetrations, tears, and cuts with self-adhesive tape, providing an airtight seal.

5. Locate laps at framing members; at laps fasten one sheet to framing member then tape overlapping sheet to first sheet in shingle fashion to shed water.
6. Seal entire perimeter to structure, window and door frames, and other penetrations.
7. Where conduits, pipes, wires, ducts, outlet boxes, and other items are installed within insulation cavity, pass vapor retarder sheet behind these items and over insulation to maintain airtight seal.

F. Self-Adhered Sheets:
1. Prepare substrate in accordance with sheet manufacturer's installation instructions; fill and tape joints in substrate and between dissimilar materials.
2. Lap sheets shingle fashion to shed water and seal laps airtight.
3. Once sheets are in place, press firmly into substrate with resilient hand roller; ensure that laps are firmly adhered with no gaps or fishmouths.
4. Use same material, or other material approved by sheet manufacturer, to seal sheets to adjacent substrates, and as flashing.
5. At expansion joints, provide transition to joint assemblies approved by sheet manufacturer.

G. Vapor Retarder Coatings:
1. Prepare substrate in accordance with coating manufacturer's installation instructions; treat joints in substrate and between dissimilar materials as indicated.
2. Where exterior masonry veneer is being installed, install masonry anchors before installing vapor retarder over masonry; provide airtight seal around anchors.
3. Apply bead or trowel coat of mastic sealant with minimum thickness of 1/4 inch (6 mm) along coating seams, rough cuts, and as recommended by manufacturer.
4. Apply flashing to seal with adjacent construction and to bridge joints in coating substrate.

H. Openings and Penetrations in Exterior Vapor Retarders:
1. Install flashing over sills, covering entire sill framing member, and extend at least 5 inches (127 mm) onto vapor retarder and at least 6 inches (152 mm) up jambs; mechanically fasten stretched edges.
2. At openings 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 (100 mm) wide; do not seal sill flange.
3. At openings with nonflanged frames, seal vapor retarder to each side of framing at opening using flashing at least 9 inches (230 mm) wide, and covering entire depth of framing.
4. At head of openings, install flashing under vapor retarder extending at least 2 inches (50 mm) beyond face of jambs; seal vapor retarder to flashing.
5. At interior face of openings, seal gaps between window/door frame and rough framing using appropriate joint sealant over backer rod.
6. Service and Other Penetrations: Form flashing around penetrating items and seal to surface of vapor retarder.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Owner’s Inspection and Testing: Cooperate with Owner’s testing agency.
1. Allow access to work areas and staging.
2. Notify Owner’s testing agency in writing of schedule for work of this section to allow sufficient time for testing and inspection.
3. Do not cover work of this section until testing and inspection is accepted.

C. Obtain approval of installation procedures from vapor retarder manufacturer based on a mock-up installed in place, prior to proceeding with remainder of installation.

D. Take digital photographs of each portion of installation prior to covering up vapor retarders.

3.05 PROTECTION

A. Do not leave materials exposed to weather longer than recommended by manufacturer.

END OF SECTION

SECTION 07 2700 - AIR BARRIERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air barriers.

1.02 RELATED REQUIREMENTS

A. Section 07 6200 - Sheet Metal Flashing and Trim: Metal flashings installed in conjunction with air barriers.

1.03 DEFINITIONS

A. Air Barrier: Airtight barrier made of material that is virtually air impermeable but water vapor permeable, both to amount as specified, with sealed seams and sealed joints to adjacent surfaces.

1.04 REFERENCE STANDARDS

A. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2016 (Reapproved 2021).

B. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2021.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018.

D. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.

E. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials; 2021a.

F. ICC-ES AC148 - Acceptance Criteria for Flexible Flashing Materials; 2017, with Editorial Revision (2021).

G. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components; 2025.

1.05 SUBMITTALS

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

B. Product Data: Provide data on material characteristics, performance criteria, and limitations.

C. Shop Drawings: Provide drawings of special joint conditions.

D. Manufacturer's Installation Instructions: Indicate preparation, installation methods, and storage and handling criteria.

1.06 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by materials manufacturers before, during, and after installation.

PART 2 PRODUCTS

2.01 AIR BARRIER MATERIALS (AIR IMPERMEABLE AND WATER VAPOR PERMEABLE)

A. (AIR BAR-3): Contractor's option to provide a self-adhesive or liquid applied membrane as described in the following paragraphs.

B. Air Barrier Sheet, Self-Adhered (AIR BAR-3):

1. Air Permeance: 0.004 cfm/sq ft (0.02 L/(s sq m)), maximum, when tested in accordance with ASTM E2178.

2. Water Vapor Permeance: 10 perms (572 ng/(Pa s sq m)), minimum, when tested in accordance with ASTM E96/E96M using Procedure A - Desiccant Method, at 73.4 degrees F (23 degrees C).
3. Water Penetration Resistance Around Nails: Pass, when tested in accordance with ASTM D1970/D1970M (modified).
4. Ultraviolet (UV) and Weathering Resistance: Approved by manufacturer for up to 180 days of weather exposure.
5. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less, Class A when tested in accordance with ASTM E84.
6. Comply with NFPA 285 requirements for wall assembly.
7. Seam and Perimeter Tape: As recommended by sheet manufacturer.
8. Basis of Design: Henry Company; Blueskin VP160: www.henry.com/#sle.
9. Other Acceptable Products provided they meet or exceed the Basis of Design performance.
    a. GCP Applied Technologies; Perm-A-Barrier VPS 30: www.gcpat.com/#sle.
    b. VaproShield, LLC; WrapShield SA - Self-Adhered: www.vaproshield.com/#sle.
    c. W. R. Meadows, Inc; Air-Shield SMP: www.wrmeadows.com/#sle.
    d. Substitutions: See Section 01 6000 - Product Requirements.

C. Air Barrier, Fluid Applied (AIR BAR-3): Vapor semi-permeable, elastomeric waterproofing.
1. Air Barrier Coating:
    a. Air Permeance: 0.004 cfm/sq ft (0.02 L/(s sq m)), maximum, when tested in accordance with ASTM E2178.
    b. Water Vapor Permeance: 11 perms (629 ng/(Pa s sq m)), minimum, when tested in accordance with ASTM E96/E96M using Procedure B - Water Method, at 73.4 degrees F (23 degrees C).
    c. Elongation: 250 percent, minimum, when tested in accordance with ASTM D412.
    d. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less, Class A when tested in accordance with ASTM E84.
    e. Comply with NFPA 285 requirements for wall assembly.
    f. Sealants, Tapes and Accessories: As recommended by coating manufacturer.
    g. Basis of Design: Henry Company; Air-Bloc 17MR: www.henry.com/#sle.
    h. Other Acceptable Products provided they meet or exceed the Basis of Design performance:
        1) GCP Applied Technologies; Perm-A-Barrier VPL 50RS UV Stable: www.gcpat.com/#sle.
        2) PROSOCO, Inc; R-GUARD Cat 5: www.prosoco.com/r-guard/#sle.
        3) W. R. Meadows, Inc; Air-Shield TMP: www.wrmeadows.com/#sle.
        4) Substitutions: See Section 01 6000 - Product Requirements.

2.02 ACCESSORIES

A. Sealants, Tapes, and Accessories for Sealing Air Barrier and Adjacent Substrates: As indicated or in compliance with air barrier manufacturer's installation instructions.

B. Sealant for Cracks and Joints In Substrates: Resilient elastomeric joint sealant compatible with substrate and air barrier materials.
1. Application: Apply at 30 to 40 mil, 0.030 to 0.040 inch (0.76 to 1.02 mm), nominal thickness.
2. All flashing materials shall be compatible with, and approved by, the membrane manufacturer.
3. Comply with NFPA 285 requirements for wall assembly.

C. Flexible Flashing: Self-adhering or mechanically-attached flashing used for wall penetrations in accordance with ICC-ES AC148 requirements.

D. Thinners and Cleaners: As recommended by material manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and conditions are ready for work of this section.

B. Where existing conditions are responsibility of another installer, notify Architect of unsatisfactory conditions.

C. Do not proceed with this work until unsatisfactory conditions have been corrected.

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 adhesives and sealants in accordance with manufacturer's installation instructions.

3.03 INSTALLATION

A. Install materials in accordance with manufacturer's installation instructions.

B. Air Barriers: Install continuous airtight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.

C. Apply sealants and adhesives within recommended temperature range in accordance with manufacturer's installation instructions.

D. Self-Adhered Sheets:

1. Prepare substrate in accordance with sheet manufacturer's installation instructions; fill and tape joints in substrate and between dissimilar materials.
2. Lap sheets shingle fashion to shed water and seal laps airtight.
3. Once sheets are in place, press firmly into substrate with resilient hand roller; ensure that laps are firmly adhered with no gaps or fishmouths.
4. Use same material, or other material approved by sheet manufacturer, to seal to adjacent substrates, and as flashing.
5. At wide joints, provide extra flexible membrane allowing joint movement.

E. Openings and Penetrations in Exterior Air Barriers:

1. Install flashing over sills, covering entire sill frame member, extending at least 5 inches (125 mm) onto air barrier and at least 6 inches (150 mm) up jambs; mechanically fasten stretched edges.
2. At openings 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 (100 mm) wide; do not seal sill flange.
3. At openings with nonflanged frames, seal air barrier to each side of framing at opening using flashing at least 9 inches (230 mm) wide, and covering entire depth of framing.
4. At head of openings, install flashing under air barrier extending at least 2 inches (50 mm) beyond face of jambs; seal air 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 air barrier surface.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Obtain approval of installation procedures from air barrier manufacturer based on a mock-up installed in place, prior to proceeding with remainder of installation.

C. Take digital photographs of each portion of installation prior to covering up air barriers.

3.05 PROTECTION

A. Do not leave materials exposed to weather longer than recommended by manufacturer.

END OF SECTION

SECTION 07 4213 - METAL WALL PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Manufactured metal panels for walls and soffits, with related flashings and accessory components.

1.02 RELATED REQUIREMENTS

A. Section 05 4000 - Cold-Formed Metal Framing: Wall panel substrate.
B. Section 07 2600 - Vapor Retarders: Vapor retarder under wall panels.
C. Section 07 9200 - Joint Sealants: Sealing joints between metal wall panel system and adjacent construction.
D. Section 09 2116 - Gypsum Board Assemblies: Wall panel substrate.

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; 2017.
B. ASTM A606/A606M - Standard Specifications for Steel, Sheet, and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance.
C. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Shop Drawings: Indicate dimensions, layout, joints, construction details, support clips, and methods of anchorage.
C. Samples: Submit two samples of wall panel, 12 inches by 12 inches (305 mm by 305 mm) in size illustrating finish color, sheen, and texture.
D. Manufacturer's qualification statement.
E. Installer's qualification statement.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.
B. Installer Qualifications: Company specializing in installing products specified in this section with minimum three years of documented experience.

1.06 MOCK-UPS

A. See Section 01 4000 - Quality Requirements for additional requirements.
B. Pre-installation meeting.
C. Locate as directed by Architect.
D. Mock-up may remain as part of work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.
B. Store prefinished material off the ground and protected from weather; prevent twisting, bending, or abrasion; provide ventilation; slope metal sheets to ensure proper drainage.
C. Prevent contact with materials that may cause discoloration or staining of products.

1.08 WARRANTY

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

B. Finish Warranty: Provide 15-year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking. Complete forms in Owner's name and register with warrantor.

C. Special Warranty: Provide 2-year warranty covering water tightness and integrity of seals of metal wall panels. Complete forms in Owner's name and register with warrantor.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Wall Panels - Exposed Fasteners:

1. ATAS International, Inc: www.atas.com.
2. Berridge Manufacturing Company: www.berridge.com.
3. Morin Corporation: www.morincorp.com.
4. Petersen Aluminum Corporation: www.pac-clad.com.
5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MANUFACTURED METALS

A. Wall Panel System: Factory fabricated weathered metal panel system, site assembled.

1. Provide exterior panels.
2. Design and size components to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of wall.
3. Design Pressure: In accordance with applicable codes.
4. Maximum Allowable Deflection of Panel: L/90 for length(L) of span.
5. Movement: Accommodate movement within system without damage to components or deterioration of seals, movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; and deflection of structural support framing.
6. Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.
7. Fabrication: Formed true to shape, accurate in size, square, and free from distortion or defects; pieces of longest practical lengths.
8. Corners: Factory-fabricated in one continuous piece with minimum 18-inch (450 mm) returns.

B. Exterior or Interior Aluminum Metal Wall Panels (MTL FAB-11):

1. Basis of Design: Face Fastened System by PURE+FREEFORM: www.purefreeform.com.
   a. Finish: See drawings.
   b. Fastening: Face fastened system, exposed fasteners, large fasteners
   c. Aluminum Thickness: 2 mm.
   d. Texture: Smooth.
   e. Size: As indicated on drawings.
2. Material: Precoated steel sheet, 22 gauge, 0.0299 inch (0.76 mm) minimum thickness.
3. Color: As selected by Architect from manufacturer's standard line.

C. Weathering Steel Panels:

1. Basis of Design: A606 Natural Weathered Steel:
   a. (WTHR STL-1): Exterior Wall Panels.

1) Profile: Solid Flat.
2) Thickness: 11 gauge.

b. (WTHR STL-2): Exterior Soffit Panels.
1) Profile: Solid Flat.
2) Thickness: 11 gauge.

c. (WTHR STL-3): Exterior Utility Enclosure Panels.
1) Profile: Perforated Flat.
2) Perforations: 1/4 inch round on 3/8 inch staggered centers.
3) Open Area: 40%.
4) Thickness: 8 gauge.

d. (WTHR STL-4): Interior Wall Panels; sealed.
1) Finish: Prepatinated Steel with Panel Coating.
2) Thickness: 11 gauge.

2. Fastener: Exposed stainless steel fastener panel with black nylon faced washers.
3. Color: As selected by Architect.
4. Interior Panel Coating:
a. Basis of Design: Bromoco CT-7571 weather steel sealer by Bromoco Internations: www.bromocointernational.com.

D. Internal and External Corners: Same material, thickness, and finish as exterior sheets; profile to suit system; shop cut and factory mitered to required angles.

E. Trim: Same material, thickness and finish as exterior sheets; brake formed to required profiles.

F. Anchors: Stainless steelwith black nylon faced washers.

2.03 MATERIALS

A. Precoated Steel Sheet: Hot-dipped galvanized steel sheet, ASTM A653/A653M, Structural Steel (SS) or Forming Steel (FS), with G90/Z275 coating; continuous coil-coated on exposed surfaces with specified finish coating and on panel back with specified panel back coating.

B. Precoated Aluminum Sheet: ASTM B209/B209M, with smooth surface texture; continuous-coil-coated on exposed surfaces with specified finish coating and on panel back with specified panel back coating. FEVE Fluoropolymer: AAMA 2605. 100 percent fluoroethylene vinyl ether (FEVE) resin in color coat.

C. Weathering Steel: ASTM A606/A606M, Type 4. Standard mill finish.

2.04 ACCESSORIES

A. Gaskets: Manufacturer's standard type suitable for use with system, permanently resilient.

B. Bituminous Paint: Asphalt base.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify air barrier, see Section 07 2700, has been installed over wall panel substrate; see Section 05 4000.

3.02 INSTALLATION

A. Install panels on walls in accordance with manufacturer's instructions.

B. Protect surfaces in contact with cementitious materials and dissimilar metals with bituminous paint; allow to dry prior to wall panel installation.

C. Fasten panels to structural supports; aligned, level, and plumb.

D. Locate joints over supports.

E. Provide expansion and control joints where indicated.

F. Use concealed fasteners unless otherwise indicated by Architect.

G. Seal and place gaskets to prevent weather penetration. Maintain neat appearance.

3.03 TOLERANCES

A. Offset From True Alignment Between Adjacent Members Abutting or In Line: 1/16 inch (1.6 mm), maximum.

B. Variation from Plane or Location As Indicated on Drawings: 1/4 inch (6.4 mm), maximum.

3.04 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 5300 - ELASTOMERIC MEMBRANE ROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Elastomeric roofing membrane, ballasted conventional application.
B. Insulation, flat and tapered.
C. Vapor retarder.
D. Roof sheathing.
E. Roofing cant strips, stack boots, roofing expansion joints, and walkway pads.
F. Roof pavers systems.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Wood cant strips.

1.03 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
B. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2024.
C. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2025.
D. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2016 (Reapproved 2021).
E. ASTM D448 - Standard Classification for Sizes of Aggregate for Road and Bridge Construction; 2012 (Reapproved 2022).
F. ASTM D624 - Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers; 2000 (Reapproved 2020).
G. ASTM D746 - Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact; 2024.
H. ASTM D4637/D4637M - Standard Specification for EPDM Sheet Used in Single-Ply Roof Membrane; 2015, with Editorial Revision (2022).
I. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.
J. NRCA (WM) - The NRCA Waterproofing Manual; 2021.
K. SPRI RP-4 - Wind Design Standard for Ballasted Single-Ply Roofing Systems; 2022.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Product Data: Provide data indicating membrane materials, flashing materials, insulation, and fasteners.
C. Shop Drawings: Indicate joint or termination detail conditions, conditions of interface with other materials, setting plan for tapered insulation, and paver layout.
D. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original containers, dry and undamaged, with seals and labels intact.

B. Store materials in weather protected environment, clear of ground and moisture.

C. Ensure storage and staging of materials does not exceed static and dynamic load-bearing capacities of roof decking.

D. Protect foam insulation from direct exposure to sunlight.

1.07 FIELD CONDITIONS

A. Do not apply roofing membrane during unsuitable weather.

B. Do not apply roofing membrane when ambient temperature is below 40 degrees F (5 degrees C) or above 100 degrees F (38 degrees C).

C. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.

D. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.

E. Schedule applications so that no partially completed sections of roof are left exposed at end of workday.

1.08 WARRANTY

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

B. Correct defective work within a two year period after Date of Substantial Completion.

C. General Warranty: The warranties specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

D. Provide 20 year manufacturer's material and labor warranty to cover failure to prevent penetration of water.

E. Provide manufacturer's standard 72 mph wind speed warranty.

PART 2 PRODUCTS

2.01 PRODUCT REQUIREMENTS

A. Products listed as Basis of Design have been selected for specific criteria. Products from other manufacturer’s listed herein, and/or substitutions will only be accepted if they meet, or exceed, the performance of the Basis of Design. Manufacturer must be able to provide documentation showing that the product meets, or exceeds, the Basis of Design.

2.02 MANUFACTURERS

A. EPDM Membrane Materials:

1. Carlisle Roofing Systems, Inc: www.carlisle-syntec.com.
2. Elevate: www.holcimelevate.com/#sle.

3. GenFlex Roofing Systems, LLC: www.genflex.com.
4. Johns Manville: www.jm.com.
5. Mule-Hide Products Co, Inc: www.mulehide.com.
6. Versico Roofing Systems: www.versico.com.
7. Substitutions: See Section 01 6000 - Product Requirements.

B. Insulation:
1. Dow Chemical Company: www.dow.com.
2. GAF: www.gaf.com.
3. Hunter Panels, LLC: www.hpanels.com.
4. Owens Corning Corporation: www.owenscorning.com.
5. ROCKWOOL: www.rockwool.com.
6. Insulation manufactured by the membrane manufacturer is approved.
7. Substitutions: See Section 01 6000 - Product Requirements.

2.03 ROOFING - BALLASTED APPLICATIONS

A. Elastomeric Membrane Roofing (EPDM-1): One ply membrane loose-laid over insulation with ballast.

B. Acceptable Insulation Types- Under Membrane - Tapered Application: Any of the types specified.
1. Uniform thickness polyisocyanurate board covered with tapered polyisocyanurate board.

C. Ballast: Comply with SPRI RP-4 for Category 1, Exposure A, using aggregate over entire surface.

2.04 ROOFING MEMBRANE AND ASSOCIATED MATERIALS

A. Membrane: Ethylene-propylene-diene-monomer (EPDM); non-reinforced; complying with minimum properties of ASTM D4637/D4637M.
1. Thickness: 0.060 inch (60 mil) (1.5 mm).
2. Color: Black.
3. Tensile Strength: 1,300 psi (9.0 MPa), measured in accordance with ASTM D412.
4. Ultimate Elongation: 300 percent, minimum, measured in accordance with ASTM D412.
5. Tear Strength: 150 lbf per inch (26.3 kN/m), measured in accordance with ASTM D624.
6. Water Vapor Permeability: 0.5 perm inch (0.33 ng/(Pa s m)) maximum, measured in accordance with ASTM E96/E96M.
7. Brittleness Temperature: -49 degrees F (-45 degrees C), measured in accordance with ASTM D746.

B. Seaming Materials: As recommended by membrane manufacturer.

C. Vapor Retarder (VPR RET-5): SBS modified bitumen adhesive with high-density polyethylene top surface, complying with requirements of fire rating classification; compatible with roofing and insulation materials.
1. Fire-retardant adhesive.
2. Vapor Permeability: 0.017 perm inch (0.92 ng/(Pa s m)), measured in accordance with ASTM E96/E96M.
3. Primer: Manufacturer's standard primer as required by substrate.
4. Basis of Design: V-Force as manufactured by Firestone or roofing manufacturer's recommended equal product.

D. Flexible Flashing Material: Same material as membrane.
1. Thickness: 60 mil (1.5 mm).
2. Color: Black.

2.05 ROOF SHEATHING

A. Roof Sheathing: Glass mat faced gypsum panels, ASTM C1177/C1177M, fire resistant type, 1/2 inch (12.7 mm) thick.
   1. (RF BRD-1) Thickness: 1/2 inch (12.7 mm), Type X, fire-resistant.
   2. Products:
      a. Georgia-Pacific; DensDeck Prime with EONIC Technology: www.densdeck.com.
      b. USG Corporation; Securock Ultralight Glass-Mat Roof Board: www.usg.com.
      c. Substitutions: See Section 01 6000 - Product Requirements.

2.06 INSULATION

A. Insulation System Identification:
   1. (INSUL-50): Constant thickness polyisocyanurate insulation; minimum two staggered layers of equal thickness; provide tapered polyisocyanurate insulation as needed.
   2. (INSUL-51): Tapered polyisocyanurate insulation over constant thickness polyisocyanurate insulation; minimum two staggered layers of equal thickness; provide tapered insulation over entire roof as indicated in the drawings.

B. Polyisocyanurate (ISO) Board Insulation: Rigid cellular foam, complying with ASTM C1289.
   1. Classifications:
      a. Type II: Faced with either cellulosic facers or glass fiber mat facers on both major surfaces of the core foam.
         1) Class 1 - Faced with glass fiber reinforced cellulosic facers on both major surfaces of the core foam.
         2) Compressive Strength: Classes 1-2-3, Grade 2 - 20 psi (138 kPa), minimum.
         3) Thermal Resistance, R-value (RSI-value): At 1-1/2 inches (38 mm) thick; Class 1, Grades 1-2-3 - 8.4 (1.48) at 75 degrees F (24 degrees C).
   2. Board Size: 48 by 96 inches (1220 by 2440 mm).
   3. Tapered Board: Slope as indicated; minimum thickness 1/2 inch (12.7 mm); fabricate of fewest layers possible.
   4. Board Edges: Square.

2.07 BALLAST MATERIALS

A. No.2 Aggregate: Sound, hard, washed crushed gravel, with Size Number 2 or 1 in accordance with ASTM D448.

2.08 ROOF PAVERS SYSTEMS

A. Precast Concrete Roof Pavers (PAVER-1): Precast concrete tiles, with texture and color as indicated; supported by adjustable pedestal system.
   1. Comply with local wind load resistance requirements of ASCE 7.
   2. Texture: As selected by Architect from manufacturer's standard line.
   3. Length and Width: 23-7/8 by 23-7/8 inches (606 by 606 mm), nominal.
   4. Thickness: 2 inches (51 mm), nominal.

2.09 ACCESSORIES

A. Cant and Edge Strips: Wood fiberboard, compatible with roofing materials ; cants formed to 45 degree angle.

B. Membrane Adhesive: As recommended by membrane manufacturer.

C. Surface Conditioner for Adhesives: Compatible with membrane and adhesives.

D. Thinners and Cleaners: As recommended by adhesive manufacturer, compatible with membrane.

E. Sealants: As recommended by membrane manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and site conditions are ready to receive work.

B. Verify deck is supported and secure.

C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.

D. Verify deck surfaces are dry and free of snow or ice.

E. Verify that roof openings, curbs, and penetrations through roof are solidly set, and cant strips are in place.

3.02 INSULATION - UNDER MEMBRANE

A. Install vapor retarder to deck surface with adhesive in accordance with manufacturer's instructions.

1. Extend vapor retarder under cant strips and blocking to deck edge.
2. Install flexible flashing from vapor retarder to air seal material of wall construction, lap and seal to provide continuity of the air barrier plane.

B. Ensure vapor retarder is clean and dry, continuous, and ready for application of insulation.

C. Attachment of Insulation: Contractors option to mechanically fasten, adhesively attach, or a combination of mechanical and adhesive attachment of roof insulation, provided all other roof system requirements are met including warranty requirements.

D. Lay subsequent layers of insulation with joints staggered minimum 6 inches (152 mm) from joints of preceding layer.

E. Place tapered insulation to the required slope pattern in accordance with manufacturer's instructions.

F. Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.

G. At roof drains, use factory-tapered boards to slope down to roof drains over a distance of 18 inches (457 mm).

H. Do not apply more insulation than can be covered with membrane in same day.

3.03 INSTALLATION - MEMBRANE

A. Install elastomeric membrane roofing system in accordance with manufacturer's recommendations and NRCA (WM) applicable requirements.

B. Roll out membrane, free from wrinkles or tears. Place sheet into place without stretching.

C. Shingle joints on sloped substrate in direction of drainage.

D. Overlap edges and ends and seal seams by contact adhesive, minimum 3 inches (76 mm). Seal permanently waterproof. Apply uniform bead of sealant to joint edge.

E. At intersections with vertical surfaces:

1. Extend membrane over cant strips and up a minimum of 4 inches (102 mm) onto vertical surfaces.
2. Fully adhere flexible flashing over membrane and up to nailing strips.

F. At gravel stops, extend membrane under gravel stop and to the outside face of the wall.

G. Around roof penetrations, seal flanges and flashings with flexible flashing.

H. Coordinate installation of roof drains and sumps and related flashings.

3.04 INSTALLATION - PAVERS AND EDGE TREATMENT

A. Install pavers on pedestals in accordance with manufacturer's instructions.
   1. Fully support edges; shim and adjust pavers to provide level surface.
   2. Provide approximately 1/8 inch (3.2 mm) space between pavers to permit surface water drainage.

3.05 INSTALLATION - BALLAST

A. Ballast: Evenly distribute aggregate ballast, and install in accordance with SPRI RP-4.

3.06 CLEANING

A. See Section 01 7000 - Execution and Closeout Requirements for additional requirements.
B. Remove bituminous markings from finished surfaces.
C. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and comply with their documented instructions.
D. Repair or replace defaced or damaged finishes caused by work of this section.

3.07 PROTECTION

A. Protect installed roofing and flashings from construction operations.
B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

END OF SECTION

SECTION 07 6200 - SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fabricated sheet metal items.

B. Sealants for joints within sheet metal fabrications.

1.02 REFERENCE STANDARDS

A. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018 (Reapproved 2024).

B. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2024).

C. CDA A4050 - Copper in Architecture - Handbook; current edition.

D. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.03 SUBMITTALS

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

B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

1.04 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.

1.05 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 Aluminum (SMF-1): ASTM B209 (ASTM B209M); 0.032 inch (0.8 mm) thick; plain finish shop pre-coated with fluoropolymer coating.

1. Fluoropolymer Coating: High Performance Organic Finish, AAMA 2604; multiple coat, thermally cured fluoropolymer finish system.
2. Color: As selected by Architect from manufacturer's standard colors.

B. Weathering Steel Panels (SMF-2):

1. Thickness: 22 gauge.
2. Color: Truten A605 weathered steel.
3. See Section 07 4213.

C. Stainless Steel (SMF-3): ASTM A666, Type 304 alloy, soft temper, 28 gauge, (0.0156 inch) (0.40 mm) thick, smooth No. 4 - Brushe

2.02 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

B. Form pieces in longest possible lengths.

C. Hem exposed edges on underside 1/2 inch (13 mm); miter and seam corners.

D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
E. Fabricate corners from one piece with minimum 18-inch (450 mm) long legs; seam for rigidity, seal with sealant.
F. Fabricate flashings to allow toe to extend 2 inches (50 mm) over roofing gravel. Return and brake edges.

2.03 ACCESSORIES

A. Fasteners: Galvanized steel, with soft neoprene washers.
B. Primer Type: Zinc chromate.
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. Asphalt Roof Cement: ASTM D4586/D4586M, Type I, asbestos-free.

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. Install surface mounted reglets true to lines and levels, and seal top of reglets with sealant.
C. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil, 0.015 inch (0.38 mm).

3.03 INSTALLATION

A. Insert flashings into reglets to form tight fit; secure in place with lead wedges; seal flashings into reglets with sealant.
B. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted.
C. Apply plastic cement compound between metal flashings and felt flashings.
D. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.
E. Seal metal joints watertight.

END OF SECTION

SECTION 07 7200 - ROOF ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Roof hatches.

1.02 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2017.

D. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process; 2023.

1.03 SUBMITTALS

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

B. Product Data: Manufacturer's data sheets on each product to be used.

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.
4. Maintenance requirements.

C. Shop Drawings: Submit detailed layout developed for this project and provide dimensioned location and number for each type of roof accessory.

1.04 DELIVERY, STORAGE, AND HANDLING

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

B. Store products under cover and elevated above grade.

PART 2 PRODUCTS

2.01 ROOF HATCHES AND VENTS

A. Roof Hatch Manufacturers:

1. Activar Construction Products Group, Inc. - JL Industries: www.activarcpg.com/#sle.
2. Acudor Products Inc: www.acudor.com.
3. Babcock-Davis: www.babcockdavis.com.
4. BILCO Company: www.bilco.com.
5. Nystrom, Inc: www.nystrom.com/#sle.
6. Substitutions: See Section 01 6000 - Product Requirements.

B. Roof Hatches and Smoke Vents (RF HATCH-1): Factory-assembled aluminum frame and cover, complete with operating and release hardware.

1. Style: Provide flat metal covers unless otherwise indicated; compatible with 60 degree ships ladder.
2. Mounting Substrate: Provide frames and curbs suitable for mounting on standing seam metal roof panel system.

3. Size: As indicated on drawings; single-leaf style unless otherwise indicated.
4. Capable of supporting 40 psf (1.92 kPa) live load.
5. Insulation: Manufacturer's standard 1 inch (25 mm) rigid glass fiber.
6. Gasket: Neoprene, continuous around cover perimeter.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using methods recommended by manufacturer for achieving acceptable results for applicable substrate under project conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions, in manner that maintains roofing system weather-tight integrity.

3.04 CLEANING

A. Clean installed work to like-new condition.

3.05 PROTECTION

A. Protect installed products until completion of project.

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

END OF SECTION

SECTION 07 8400 - FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Firestopping systems.

B. Firestopping of 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 E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2024.

B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2024.

C. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems; 2024.

D. ASTM E2307 - Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-Story Test Apparatus; 2025.

E. ASTM E2837 - Standard Test Method for Determining the Fire Resistance of Continuity Head-of-Wall Joint Systems Installed between Rated Wall Assemblies and Nonrated Horizontal Assemblies; 2023a, with Editorial Revision (2024).

F. ITS (DIR) - Directory of Listed Products; Current Edition.

G. FM (AG) - FM Approval Guide; Current Edition.

H. UL 1479 - Standard for Fire Tests of Penetration Firestops; Current Edition, Including All Revisions.

I. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; Current Edition, Including All Revisions.

J. UL (DIR) - Online Certifications Directory; Current Edition.

K. UL (FRD) - Fire Resistance Directory; Current Edition.

1.03 SUBMITTALS

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

B. Product Data: Provide data on product characteristics, performance ratings, and limitations.

C. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Certificate from authority having jurisdiction indicating approval of materials used.

F. Manufacturer's qualification statement.

G. Installer's qualification statement.

1.04 QUALITY ASSURANCE

A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.

1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.
2. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at www.icc-es.org 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. Verification of minimum three years documented experience installing work of this type.

D. Firestop sealants upon curing, shall not re-emulsify, dissolve, leach, breakdown or otherwise be damaged over time from exposure to atmospheric moisture, sweating pipes, ponding water or other forms of moisture characteristic in a building's normal operating life.

E. Firestop sealants selected shall be sufficiently flexible to accommodate motion such as pipe vibration, water-hammer, thermal expansion, and other normal building movement, without damage to the seal.

F. One manufacturer shall supply all firestopping material to the extent possible.

G. All firestop materials shall be installed prior to expiration of shelf life.

1.05 COORDINATION

A. Schedule firestopping after installation of penetrants, but prior to concealing the openings.

B. Firestopping shall precede gypsum board finishing.

1.06 FIELD CONDITIONS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.

B. Provide ventilation in areas where solvent-cured materials are being installed.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Firestopping Manufacturers:

1. 3M Fire Protection Products: www.3m.com/firestop.
2. A/D Fire Protection Systems Inc: www.adfire.com.
3. Hilti, Inc: www.us.hilti.com.
4. Nelson FireStop Products: www.nelsonfirestop.com.
5. Specified Technologies Inc: www.stifirestop.com.
6. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com.
7. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Firestopping Materials: Any materials meeting requirements.

B. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.

C. Fire Ratings: Refer to drawings for required systems and ratings.

2.03 FIRESTOPPING ASSEMBLY REQUIREMENTS

A. Perimeter Fire Containment Firestopping: Use system that has been tested according to ASTM E2307 to have fire resistance F Rating equal to required fire rating of floor assembly.

1. Movement: Provide systems that have been tested to show movement capability as indicated.
2. Temperature Rise: Provide systems that have been tested to show T Rating as indicated.
3. Air Leakage: Provide systems that have been tested to show L Rating as indicated.
4. Where floor assembly is not required to have a fire rating, provide systems that have been tested to show L Rating as indicated.

B. Head-of-Wall (HW) Joint System Firestopping at Joints Between Fire-Rated Wall Assemblies and Non-Rated Horizontal Assemblies: Use system that has been tested according to ASTM E2837 to have fire resistance F Rating equal to required fire rating of wall assembly.
   1. Movement: Provide systems that have been tested to show movement capability as indicated.

C. Floor-to-Floor (FF), Floor-to-Wall (FW), Head-of-Wall (HW), and Wall-to-Wall (WW) Joints, Except Perimeter, Where Both Are Fire-Rated: Use system that has been tested according to ASTM E1966 or UL 2079 to have fire resistance F Rating equal to required fire rating of the assembly in which the joint occurs.
   1. Movement: Provide systems that have been tested to show movement capability as indicated.
   2. Air Leakage: Provide systems that have been tested to show L Rating as indicated.
   3. Watertightness: Provide systems that have been tested to show W Rating as indicated.
   4. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.

D. Through Penetration Firestopping: Use system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.
   1. Temperature Rise: Provide systems that have been tested to show T Rating as indicated.
   2. Air Leakage: Provide systems that have been tested to show L Rating as indicated.
   3. Watertightness: Provide systems that have been tested to show W Rating as indicated.
   4. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.

2.04 FIRESTOPPING SYSTEMS

A. Firestopping (FR STOP): Any material meeting requirements.
   1. Fire Ratings: Use system that is listed by FM (AG), ITS (DIR), or UL (FRD) and tested in accordance with ASTM E814, ASTM E119, or UL 1479 with F Rating equal to fire rating of penetrated assembly and minimum T Rating Equal to F Rating and in compliance with other specified requirements.

PART 3 EXECUTION

3.01 CONDITIONS REQUIRING FIRESTOPPING

A. General: Provide firestopping for conditions specified whether or not firestopping is indicated, and if indicated, whether such materials designated as insulation, safing, or otherwise.

B. Through-Penetration: Firestopping shall be installed in all open penetrations and in the annular space in all penetrations in any bearing or non-bearing fire-rated barrier.

C. Membrane-Penetration: Where required by code, all membrane-penetrations in rated walls shall be protected with firestopping products that meet the requirements of third party time/temperature testing.

D. Construction Joints/Gaps: Firestopping shall be provided at all fire rated walls as indicated on project drawings.
   1. Between the tops of walls and the underside of floors.
   2. In expansion joints at fire rated walls.
   3. In any penetration through fire rated wall, fill gaps and spaces with fire stopping material sufficient to maintain intended wall rating.
   4. Smoke-Stopping: As required by the other sections, smoke-stops shall be provided for through-penetrations, membrane-penetrations, and construction gaps with a material approved and tested for such application.

3.02 EXAMINATION

A. Verify openings are ready to receive the work of this section.

3.03 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.

B. Remove incompatible materials that could adversely affect bond.

C. Install backing materials to prevent liquid material from leakage.

3.04 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 authorities having jurisdiction.

C. Install labeling required by code.

3.05 MARKING AND IDENTIFICATION

A. Fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions or any other wall required to have protected openings or penetrations shall be effectively and permanently identified with signs or stenciling. Such identification shall:

1. Be located in accessible concealed floor, floor-ceiling or attic spaces;
2. Be located within 15 feet (4572 mm) of the end of each wall and at intervals not exceeding 30 feet (9144 mm) measured horizontally along the wall or partition; and
3. Include lettering not less than 3 inches (76 mm) in height with a minimum 3/8 inch (9.5 mm) stroke in a contrasting color incorporating the suggested wording. "FIRE AND/OR SMOKE BARRIER-PROTECT ALL OPENINGS" or other wording.

3.06 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.07 PROTECTION

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 07 9200 - JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

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

1.02 RELATED REQUIREMENTS

A. Section 09 2116 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.
B. Section 09 3000 - Tiling: Sealant between tile and plumbing fixtures and at junctions with other materials and changes in plane.

1.03 REFERENCE STANDARDS

A. ASTM C794 - Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants; 2018 (Reapproved 2022).
B. ASTM C834 - Standard Specification for Latex Sealants; 2017 (Reapproved 2023).
C. ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems; 2023.
D. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2025.
E. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants; 2023.
F. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2015 (Reapproved 2021).

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Product Data: Submit manufacturer's technical datasheets for each product to be used; include the following:
    1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
    2. List of backing materials approved for use with the specific product.
    3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
    4. Substrates the product should not be used on.
C. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.
D. Samples for Verification: Where custom sealant color is specified, obtain directions from Architect and submit at least two physical samples for verification of color of each required sealant.
E. Preconstruction Laboratory Test Reports: Submit at least four weeks prior to start of installation.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of experience.
B. Preconstruction Laboratory Testing: Arrange for sealant manufacturer(s) to test each combination of sealant, substrate, backing, and accessories.

1. Adhesion Testing: In accordance with ASTM C794.
2. Compatibility Testing: In accordance with ASTM C1087.
3. Allow sufficient time for testing to avoid delaying the work.
4. Deliver sufficient samples to manufacturer for testing.
5. Report manufacturer's recommended corrective measures, if any, including primers or techniques not indicated in product data submittals.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Nonsag Sealants:
1. Bostik Inc: www.bostik-us.com.
2. Dow Chemical Company: consumer.dow.com/en-us/industry/ind-building-construction.html.
3. Hilti, Inc: www.us.hilti.com.
4. Momentive Performance Materials, Inc (formerly GE Silicones): www.momentive.com.
5. Pecora Corporation: www.pecora.com.
6. Sherwin-Williams Company: www.sherwin-williams.com.
7. Sika Corporation: www.usa-sika.com.
8. Specified Technologies Inc: www.stifirestop.com.
9. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com.
10. W.R. Meadows, Inc: www.wrmeadows.com.
11. Substitutions: See Section 01 6000 - Product Requirements.

B. Self-Leveling Sealants:
1. Bostik Inc: www.bostik-us.com.
2. Dow Chemical Company: consumer.dow.com/en-us/industry/ind-building-construction.html.
3. Pecora Corporation: www.pecora.com.
4. Sherwin-Williams Company: www.sherwin-williams.com.
5. Sika Corporation: www.usa-sika.com.
6. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com.
7. W.R. Meadows, Inc: www.wrmeadows.com.
8. Substitutions: See Section 01 6000 - Product Requirements.

2.02 JOINT SEALANT APPLICATIONS

A. Scope:
1. Exterior Joints:
   a. Do not seal exterior joints unless indicated on drawings as sealed.
   b. Seal open joints except open joints indicated on drawings as not sealed.
2. Interior Joints:
   a. Do not seal interior joints indicated on drawings as not sealed.
   b. Do not seal gaps and openings in gypsum board and suspended ceilings
   c. Do not seal through-penetrations in sound-rated assemblies that are also fire-rated assemblies.
   d. Seal open joints except specific open joints indicated on drawings as not sealed.
3. Do Not Seal:
   a. Intentional weep holes in masonry.
   b. Joints indicated to be covered with expansion joint cover assemblies.

c. Joints where sealant is specified to be furnished and installed by manufacturer of product to be sealed.
d. Joints where sealant installation is specified in other sections.
e. Joints between suspended ceilings and walls.

B. Exterior Joints: Use non-sag non-staining silicone sealant, unless otherwise indicated.
1. Lap Joints in Sheet Metal Fabrications: Butyl rubber, non-curing.

C. Interior Joints: Use non-sag polyurethane sealant, unless otherwise indicated.
1. Wall and Ceiling Joints in Wet Areas: Non-sag polyurethane sealant for continuous liquid immersion.
2. Floor Joints in Wet Areas: Non-sag polyurethane "non-traffic-grade" sealant suitable for continuous liquid immersion.
3. Joints between Fixtures in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; white.
4. In Sound-Rated Assemblies: Acrylic emulsion latex sealant.
5. Narrow Control Joints in Interior Concrete Slabs: Self-leveling epoxy sealant.
6. Other Floor Joints: Self-leveling polyurethane "traffic-grade" sealant.

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

2.03 JOINT SEALANTS - GENERAL

A. Material ID's:
1. (SEALANT-1): Joint sealant or caulking with or without backer rod. Type as indicated above.

2.04 NONSAG JOINT SEALANTS

A. Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
1. Color: To be selected by Architect from manufacturer's standard range.
2. Cure Type: Multi-component, neutral curing.
3. Service Temperature Range: Minus 20 to 180 degrees F (Minus 29 to 82 degrees C).

B. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, nonstaining, nonbleeding, non-sagging; not intended for exterior use.
1. Color: To be selected by Architect from manufacturer's standard range.
2. Grade: ASTM C834; Grade 0 Degrees F (Minus 18 Degrees C).

2.05 SELF-LEVELING JOINT SEALANTS

A. Semi-Rigid Self-Leveling Epoxy Joint Filler: Epoxy or epoxy/polyurethane copolymer; intended for filling cracks and control joints not subject to significant movement; rigid enough to support concrete edges under traffic.
1. Composition: Multicomponent, 100 percent solids by weight.
2. Durometer Hardness: Minimum of 85 for Type A or 35 for Type D, after seven days when tested in accordance with ASTM D2240.
3. Color: To be selected by Architect from manufacturer's standard colors.
4. Joint Width, Minimum: 1/8 inch (3 mm).
5. Joint Width, Maximum: 1/4 inch (6 mm).
6. Joint Depth: Provide product suitable for joints from 1/8 inch (3 mm) to 2 inches (51 mm) in depth including space for backer rod.

2.06 ACCESSORIES

A. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.

B. Masking Tape: Self-adhesive, nonabsorbent, nonstaining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.

C. Joint Cleaner: Noncorrosive and nonstaining type, type recommended by sealant manufacturer; compatible with joint forming materials.

D. Primers: Type recommended by sealant manufacturer to suit application; nonstaining.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joints are ready to receive work.

B. Verify that backing materials are compatible with sealants.

C. Verify that backer rods are of the correct size.

3.02 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

E. Concrete Floor Joints That Will Be Exposed in Completed Work: Test joint filler in an inconspicuous area to verify that it does not stain or discolor slab.

3.03 INSTALLATION

A. Install this work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Provide joint sealant installations complying with ASTM C1193.

C. 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 backing tape where backer rod cannot be used.

E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

F. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.

G. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

H. Concrete Floor Joint Filler: After full cure, shave joint filler flush with top of concrete slab.

END OF SECTION

SECTION 08 1113 - HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

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

1.02 RELATED REQUIREMENTS

A. Section 08 7100 - Door Hardware.
B. Section 08 8000 - Glazing: Glass for doors and borrowed lites.
C. Section 09 9113 - Exterior Painting: Field painting.
D. Section 09 9123 - Interior Painting: Field painting.

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2024.
C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2023.
D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2025.
E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2017.
F. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2016.
G. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2023.
H. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2020.
I. ASTM C476 - Standard Specification for Grout for Masonry; 2018.
J. BHMA A156.115 - Hardware Preparation in Steel Doors and Frames; 2016.
K. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.
L. ITS (DIR) - Directory of Listed Products; current edition.
M. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames; 2002.
N. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2024.
O. NAAMM HMMA 840 - Guide Specifications for Receipt, Storage and Installation of Hollow Metal Doors and Frames; 2024.
P. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; 2014.
Q. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2025.
R. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2018.

S. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames; 2023.
T. UL (DIR) - Online Certifications Directory; Current Edition.
U. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

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

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.
B. Maintain at project site copies of reference standards relating to installation of products specified.

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 PRODUCT REQUIREMENTS

A. Products listed as Basis of Design have been selected for specific criteria. Products from other manufacturer's listed herein, and/or substitutions will only be accepted if they meet, or exceed, the performance of the Basis of Design. Manufacturer must be able to provide documentation showing that the product meets, or exceeds, the Basis of Design.

2.02 MANUFACTURERS

A. Hollow Metal Doors and Frames:
   1. Basis of Design: Steelcraft, an Allegion brand: www.allegion.com.
   2. Other Acceptable Manufactures provided they meet or exceed the Basis of Design performance requirements:
      a. Ceco Door or Curries, an Assa Abloy Group company: www.assaabloydss.com.
      b. Republic Doors, an Allegion brand: www.republicdoor.com.
      c. Substitutions: See Section 01 6000 - Product Requirements.

2.03 PERFORMANCE REQUIREMENTS

A. Requirements for Hollow Metal Doors and Frames:
   1. Steel Sheet: Comply with one or more of the following requirements; galvannealed steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
   2. Accessibility: Comply with ICC A117.1 and ADA Standards.
   3. Exterior Door Top Closures: Flush end closure channel, with top and door faces aligned.
   4. Door Edge Profile: Manufacturers standard for application indicated.

5. Typical Door Face Sheets: Flush.
6. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Manufacturer's standard.
7. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
    a. Provide minimum 3/16" plate steel as reinforcement for hardware. If the manufacturer's standard is for a greater thickness at specific locations, provide the thicker of the two standards.
8. Electrified Hardware Preparation:
    a. Provide electrical conduit and junction-boxes as required for electric power and signal routing and for electrical terminations as required to support electrical and electronic hardware indicated in Section 08 7100.
    b. Secure conduit and boxes to the frame and doors. Extend conduit attached to frames 12 inches above frame for connection to conduit furnished by other sections.
    c. Coordinate locations of conduit and boxes with Section 08 7100.
9. Zinc Coating for Typical Interior and/or Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvannealed) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.
    a. Based on SDI Standards: Provide at least A40/ZF120 (galvannealed) when necessary, coating not required for typical interior door applications, and at least A60/ZF180 (galvannealed) for corrosive locations.

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.

2.04 HOLLOW METAL DOORS

A. Exterior Doors: Thermally insulated.
    1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
        a. Level 3 - Extra Heavy-duty.
        b. Physical Performance Level A 1 000 000 cycles; in accordance with ANSI/SDI A250.4.
        c. Model 2 - Seamless.
        d. Door Face Metal Thickness: 16 gauge, 0.053 inch (1.3 mm), minimum.
        e. Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M.
    2. Door Thickness: 1-3/4 inches (44.5 mm), nominal.
    3. Door Finish: Factory primed and field finished.

B. Interior Doors, Non-Fire Rated:
    1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
        a. Level 3 - Extra Heavy-duty.
        b. Physical Performance Level A 1 000 000 cycles; in accordance with ANSI/SDI A250.4.
        c. Model 2 - Seamless.
        d. Door Face Metal Thickness: 16 gauge, 0.053 inch (1.3 mm), minimum.

2. Door Core Material: Manufacturers standard core material/construction and in compliance with requirements.
3. Door Thickness: 1-3/4 inches (44.5 mm), nominal.

C. Fire-Rated Doors:
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
a. Level 3 - Extra Heavy-duty.
b. Physical Performance Level A 1 000 000 cycles; in accordance with ANSI/SDI A250.4.
c. Model 2 - Seamless.
d. Door Face Metal Thickness: 16 gauge, 0.053 inch (1.3 mm), minimum.
2. Fire Rating: As indicated on Door Schedule, tested in accordance with UL 10C and NFPA 252 ("positive pressure fire tests").
a. Provide units listed and labeled by UL (DIR) or ITS (DIR).
b. Attach fire rating label to each fire rated unit.
3. Door Core Material: Manufacturers standard core material/construction in compliance with requirements.
4. Door Thickness: 1-3/4 inches (44.5 mm), nominal.

2.05 HOLLOW METAL FRAMES

A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
B. Frame Finish: Factory primed and field finished.
C. Exterior Door Frames: Full profile/continuously welded type.
1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A60/ZF180 coating.
2. Frame Metal Thickness: 14 gauge, 0.067 inch (1.7 mm), minimum.
3. Weatherstripping: Separate, see Section 08 7100.
D. Interior Door Frames, Non-Fire Rated: Face welded type.
1. Frame Metal Thickness: 16 gauge, 0.053 inch (1.3 mm), minimum; except 14 gage, 0.067 inch (1.7 mm) for masonry applications.
E. Door Frames, Fire-Rated: Face welded type.
1. Fire Rating: Same as door, labeled.
2. Frame Metal Thickness: 16 gauge, 0.053 inch (1.3 mm), minimum; except 14 gage, 0.067 inch (1.7 mm) for masonry applications.
F. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.
G. Borrowed Lites Glazing Frames: Construction and face dimensions to match door frames, and as indicated on drawings.
H. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.
I. Frames Wider than 48 inches (1219 mm): Reinforce with steel channel fitted tightly into frame head, flush with top.

2.06 FINISHES

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

2.07 ACCESSORIES

A. Glazing: As specified in Section 08 8000.

B. Grout for Frames: Mortar grout complying with ASTM C476 with maximum slump of 4 inches (102 mm) as measured in accordance with ASTM C143/C143M for hand troweling in place; plaster grout and thinner pumpable grout are prohibited.

C. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.

D. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 PREPARATION

A. 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. 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. Install door hardware as specified in Section 08 7100.

F. Comply with glazing installation requirements of Section 08 8000.

G. Coordinate installation of electrical connections to electrical hardware items.

3.04 TOLERANCES

A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.

B. Maximum Diagonal Distortion: 1/16 inch (1.6 mm) measured with straight edge, corner to corner.

3.05 ADJUSTING

A. Adjust for smooth and balanced door movement.

END OF SECTION

SECTION 08 1416 - FLUSH WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flush wood doors; flush and flush glazed configuration; fire-rated and non-rated.

1.02 RELATED REQUIREMENTS

A. Section 08 1113 - Hollow Metal Doors and Frames.

B. Section 08 7100 - Door Hardware.

C. Section 08 8000 - Glazing.

1.03 REFERENCE STANDARDS

A. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

B. UL 752 - Standard for Bullet-Resisting Equipment; Current Edition, Including All Revisions.

1.04 SUBMITTALS

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

B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.

C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.

D. Samples: Submit two samples of door veneer, 6 x 6 inch (152 x 152 mm) in size illustrating wood grain, stain color, and sheen.

E. Test Reports: Show compliance with specified requirements for the following:

1. Bullet resistant doors and frames.

F. Manufacturer's Installation Instructions: Indicate special installation instructions.

G. Warranty, executed in Owner's name.

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. Package, deliver and store doors in accordance with specified quality standard.

B. Accept doors on site in manufacturer's packaging, and inspect for damage.

C. Protect doors with resilient packaging sealed with heat shrunk plastic; do not store in damp or wet areas or areas where sunlight might bleach veneer; seal top and bottom edges with tinted sealer if stored more than one week, and break seal on site to permit ventilation.

1.07 WARRANTY

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

B. Manufacturer Warranty: Provide manufacturer's warranty on interior doors for the life of the installation. Complete forms in Owner's name and register with manufacturer.

1. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 PRODUCT REQUIREMENTS

A. Products listed as Basis of Design have been selected for specific criteria. Products from other manufacturer's listed herein, and/or substitutions will only be accepted if they meet, or exceed, the performance of the Basis of Design. Manufacturer must be able to provide documentation showing that the product meets, or exceeds, the Basis of Design.

2.02 MANUFACTURERS

A. Wood Veneer Faced Doors:
   1. Basis of Design: Forte Opening Solutions; Aspiro Select Wood Veneer Doors: www.forteopenings.com.
   2. Other Acceptable Manufactures provided they meet or exceed the Basis of Design performance requirements:
      a. Oregon Door; Architectural Series: www.oregondoor.com.
      b. VT Industries, Inc: www.vtindustries.com.
      c. Substitutions: See Section 01 6000 - Product Requirements.

B. Bullet Resistant Wood Doors:
   1. Overly Door Company: www.overly.com.
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.03 DOORS

A. Doors: See drawings for locations and additional requirements.
   1. Quality Standard: Custom Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS), unless noted otherwise.
   2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.

B. Interior Doors: 1-3/4 inches (44 mm) thick unless otherwise indicated; flush construction.
   1. Provide solid core doors at each location.
   2. Fire Rated Doors: Tested to ratings indicated on drawings in accordance with UL 10C - Positive Pressure; Underwriters Laboratories Inc (UL) or Intertek/Warnock Hersey (WHI) labeled without any visible seals when door is open.
   3. Bullet Resistant Doors: UL 752, Level 4.
   4. Wood veneer facing with factory transparent finish, as indicated on drawings.

2.04 DOOR AND PANEL CORES

A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated.

B. Bullet Resistant Doors: Equivalent to type, with bonded particleboard core (PC); rating; plies and faces as indicated above.

2.05 DOOR FACINGS

A. Veneer Facing for Transparent Finish: White Birch , veneer grade in accordance with quality standard indicated, plain sliced (flat cut), with book match between leaves of veneer, running match of spliced veneer leaves assembled on door or panel face.
   1. Vertical Edges: Same species as face veneer.
   2. "Pair Match" each pair of doors; "Set Match" pairs of doors within 10 feet (3 m) of each other when doors are closed.

2.06 DOOR CONSTRUCTION

A. Fabricate doors in accordance with door quality standard specified.
B. Provide sustainably harvested wood, sourced or labeled as specified in Section 01 6000.
C. Provide composite wood containing no added formaldehyde. See Section 01 6116.
D. Cores Constructed with stiles and rails:
    1. Provide solid blocks at lock edge and top of door for closer for hardware reinforcement.
    2. Provide solid blocking for other throughbolted hardware.
E. Where supplementary protective edge trim is required, install trim after veneer facing has been applied full-width.
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.

2.07 FINISHES - 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: Basis of Design: Ravine by VT Industries.
        c. Sheen: Satin.
B. Seal door top edge with color sealer to match door facing.

2.08 ACCESSORIES

A. Glazing: See Section 08 8000.
B. Glazing Stops: Wood, of same species as door facing, mitered corners; prepared for countersink style tamper proof screws.
C. Door Hardware: See Section 08 7100.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 INSTALLATION

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

3.03 TOLERANCES

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

3.04 ADJUSTING

A. Adjust doors for smooth and balanced door movement.

B. Adjust closers for full closure.

END OF SECTION

SECTION 08 3100 - ACCESS DOORS AND PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall- and ceiling-mounted access units.

1.02 RELATED REQUIREMENTS

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

1.03 SUBMITTALS

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

B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.

C. Shop Drawings: Indicate exact position of each access door and/or panel unit.

D. Manufacturer's Installation Instructions: Indicate installation requirements.

PART 2 PRODUCTS

2.01 ACCESS DOORS AND PANELS ASSEMBLIES

A. Wall-Mounted Units:

1. Panel Material: Steel.
2. Size: 24 inch by 24 inch (609 mm by 609 mm). To be verified with drawings and Architect before installation.
3. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
4. Gypsum Board Mounting Criteria: Provide drywall bead frame with door surface flush with wall surface.
5. Masonry Mounting Criteria: Provide surface-mounted frame with door surface flush with frame surface.

B. Ceiling-Mounted Units:

1. Size - Lay-In Grid Ceilings: To match module of ceiling grid.
2. Size - Other Ceilings: 24 inch by 24 inch (609 mm by 609 mm), or as noted by Architect.
3. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.

2.02 WALL- AND CEILING-MOUNTED ACCESS UNITS

A. Manufacturers:

1. ACUDOR Products Inc: www.acudor.com.
2. Babcock-Davis: www.babcockdavis.com.
3. Cendrex, Inc: www.cendrex.com.
4. Karp Associates, Inc: www.karpinc.com.
5. Nystrom, Inc; HVAC - Access Doors: www.nystrom.com/#sle.
6. Substitutions: See Section 01 6000 - Product Requirements.

B. Door and Frameless Units (ACC PNL-1): 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.

1. Style: Exposed frame with door surface flush with frame surface.
   a. Gypsum Board Mounting Criteria: Use drywall bead type frame.

2. Door Style: Single thickness with rolled or turned in edges.
3. Frames: 16-gauge, 0.0598-inch (1.52 mm) minimum thickness.
4. Single Steel Sheet Door Panels: 16-gauge, 0,0625-inch (1.6 mm) minimum thickness.
5. Steel Finish: Primed.
6. Size: As scheduled above unless otherwise indicated in the drawings.
7. Hardware:
    a. Hinges for Non-Fire-Rated Units: Continuous piano hinge.
    b. Latch/Lock: Screw driver slot for quarter turn cam latch.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Install frames plumb and level in openings, and secure units rigidly in place.

C. Position units to provide convenient access to concealed equipment when necessary.

END OF SECTION

SECTION 08 3613 - SECTIONAL DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Overhead sectional doors, manually operated.
B. Operating hardware and supports.
C. Electrical controls.

1.02 RELATED REQUIREMENTS

A. Section 05 5000 - Metal Fabrications: Steel channel opening frame.
B. Section 07 9200 - Joint Sealants: Sealing joints between frames and adjacent construction.

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 E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.
C. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014 (Reapproved 2021).
D. DASMA 102 - American National Standard Specifications for Sectional Doors; 2018.
E. ITS (DIR) - Directory of Listed Products; current edition.
F. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2008 (Reaffirmed 2020).
G. NEMA MG 00001 - Motors and Generators; 2024.
H. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.
I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
J. UL (DIR) - Online Certifications Directory; Current Edition.
K. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Shop Drawings: Indicate opening dimensions and required tolerances, connection details, anchorage spacing, hardware locations, and installation details.
C. Product Data: Show component construction, anchorage method, and hardware.
D. Samples: Submit two panel finish samples, 6 x 6 inch (152 x 152 mm) in size, illustrating color and finish.
E. Manufacturer's Installation Instructions: Include any special procedures required by project conditions.
F. Operation Data: Include normal operation, troubleshooting, and adjusting.
G. Maintenance Data: Include data for motor and transmission, shaft and gearing, lubrication frequency, spare part sources.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

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

C. Comply with applicable code for motor and motor control requirements.

D. 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.

1.06 WARRANTY

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

B. Extended Correction Period: Correct defective work within a 2-year period commencing on Date of Substantial Completion.

C. Manufacturer Warranty: Provide 5-year manufacturer warranty for electric operating equipment. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Sectional Doors:

1. Clopay Building Products: www.clopaydoor.com.
2. Midland Garage Door: www.midlandgaragedoor.com.
3. Overhead Door Corporation: www.overheaddoor.com/#sle.
4. Raynor Garage Doors: www.raynor.com.
5. Wayne-Dalton, a Division of Overhead Door Corporation: www.wayne-dalton.com.
6. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

A. Performance: Withstand positive and negative wind loads equal to 1.5 times design wind loads specified by local code without damage or permanent set, when tested in accordance with ASTM E330/E330M, using 10 second duration of maximum load.

B. Air Leakage Rate: Less than 0.40 cfm/sq ft (2 L/sec/sq m) when tested in accordance with ASTM E283/E283M at test pressure difference of 1.57 psf (75 Pa).

C. Thermal Transmittance: U-factor (Usi-factor) of 0.31 Btu/hr sq ft degrees F (1.76 W/sq m K), maximum, in accordance with DASMA 102.

2.03 STEEL DOORS

A. Doors: Stile and rail steel with solid and glazed panels; standard lift operating style with track and hardware; complying with DASMA 102, Commercial application.

1. Basis of Design: Thermacore Model 592 by Overhead Door Corporation.
2. Door Panels: Steel construction; outer steel sheet of 20 gauge, 0.0359 inch (0.91 mm) minimum thickness, deep ribbed profile; inner steel sheet of 27 gauge, 0.0164 inch (0.42 mm) minimum thickness, flat profile; core reinforcement sheet steel roll formed to channel shape, rabbeted weather joints at meeting rails; polyurethane insulation.
3. Door Nominal Thickness: 2 inches (51 mm) thick.
4. Exterior Finish:
   a. Factory finished with primer; Color: Gray.

5. Interior Finish:
    a. Factory finished with primer; Color: White.
6. Glazed Lites: Full panel width, one row; set in place with resilient glazing channel.
7. End Stiles: 16 gauge with thermal break.
8. R-Value: Minimum R-17.50.
9. Electric Operation: Electric control station.

2.04 COMPONENTS

A. Track: Rolled galvanized steel, 0.090 inch (2.3 mm) minimum thickness; 3 inch (75 mm) wide, continuous one piece per side; galvanized steel mounting brackets 1/4 inch (6 mm) thick.

B. Lift Mechanism: Torsion spring on cross head shaft, with braided galvanized steel lifting cables. Provide high cycle springs; minimum 100,000 cycles.

C. Sill Weatherstripping: Resilient hollow rubber strip, one piece; fitted to bottom of door panel, full length contact.

D. Jamb Weatherstripping: Roll formed steel section full height of jamb, fitted with resilient weatherstripping, placed in moderate contact with door panels.

E. Head Weatherstripping: EPDM rubber seal, one piece full length.

F. Panel Joint Weatherstripping: Neoprene foam seal, one piece full length.

G. Lock: Inside center mounted, adjustable keeper, spring activated latch bar with feature to retain in locked or retracted position; interior and exterior handle.

2.05 MATERIALS

A. Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G60/Z180 coating, plain surface.

B. Float Glass: Provide float glass glazing, unless noted otherwise.

2.06 ELECTRIC OPERATION

A. Operator, Controls, Actuators, and Safeties: Comply with UL 325; provide products listed by ITS (DIR), UL (DIR), or testing agency acceptable to authorities having jurisdiction.
    1. Provide interlock switches on motor operated units.

B. Electric Operators:
    1. Mounting: Side mounted on cross head shaft.
    2. Motor Enclosure:
        a. Exterior Doors: NEMA MG 00001, Type 4; open drip proof.
        b. Interior Doors: NEMA MG 00001, Type 1; open drip proof.
    3. Motor Rating: 1/2 hp (375 W); continuous duty.
    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 EN 10250, Type 1.
    7. Opening Speed: 12 inches per second (300 mm/s).
    8. Brake: Adjustable friction clutch type, activated by motor controller.
    9. Manual override in case of power failure.

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. 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.

F. Hand Held Transmitter: Digital control, and resettable.
    1. Quantity: to be determined.

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.

B. Apply primer to wood frame.

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. Install perimeter trim and closures.

3.04 TOLERANCES

A. Maximum Variation from Plumb: 1/16 inch (1.5 mm).

B. Maximum Variation from Level: 1/16 inch (1.5 mm).

C. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch (3 mm) from 10 ft (3 m) straight edge.

D. Maintain dimensional tolerances and alignment with adjacent work.

3.05 ADJUSTING

A. Adjust door assembly for smooth operation and full contact with weatherstripping.

B. Have manufacturer's field representative present to confirm proper operation and identify adjustments to door assembly for specified operation.

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. Do not permit construction traffic through overhead door openings after adjustment and cleaning.

END OF SECTION

SECTION 08 4313 - ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.01 SECTION INCLUDES

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

1.02 RELATED REQUIREMENTS

A. Section 08 7100 - Door Hardware: Hardware items other than specified in this section.
B. Section 08 8000 - Glazing: Glass and glazing accessories.

1.03 REFERENCE STANDARDS

A. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site; 2015.
B. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document); 2015.
C. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).
D. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.
E. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
F. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
G. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
H. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.
I. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.
J. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014 (Reapproved 2021).
K. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2016).
L. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.

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 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, door hardware, and internal drainage details.

C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.

D. Design Data: Provide framing member structural and physical characteristics, engineering calculations, and dimensional limitations.

E. Energy Performance Certification: For each aluminum framed storefront system and glazing combination provide NFRC CMAST Bid Report. Coordinate with Section 08 8000.

1.06 QUALITY ASSURANCE

A. Designer Qualifications: Design structural support framing components 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. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

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

1.07 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.

1.08 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C). Maintain this minimum temperature during and 48 hours after installation.

1.09 WARRANTY

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

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.

D. 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 BASIS OF DESIGN -- FRAMING FOR INSULATING GLAZING (ALSTOR-1)

A. Front-Set Style, Thermally-Broken:

1. 2 inch by 4-1/2 inch, nominal frame profile.
    a. Basis of Design: Kawneer Company, Inc; Trifab VersaGlaze 451T; www.kawneer.com.
    b. Other Acceptable Manufactures provided they meet or exceed the Basis of Design performance requirements:
        1) EFCO Corporation; www.apogeearch.com.
        2) Oldcastle Building Envelope; www.obe.com.
        3) Tubelite Inc: www. apogeearch.com.
        4) YKK AP America Inc; www.ykkap.com.

2.02 BASIS OF DESIGN -- FRAMING FOR MONOLITHIC GLAZING (ALSTOR-2)

A. Center-Set Style, Not Thermally-Broken:

1. 2 inch by 4-1/2 inch, nominal frame profile.
    a. Basis of Design: Kawneer Company, Inc; Trifab VersaGlaze 451; www.kawneer.com.
    b. Other Acceptable Manufactures provided they meet or exceed the Basis of Design performance requirements:
        1) EFCO Corporation; Series 402; www.efcocorp.com.
        2) Oldcastle Building Envelope; FG-3000; obe.com.
        3) Tubelite Inc; E14000 Series; www.tubeliteinc.com.
        4) YKK AP America Inc; YES 45 FI; www.ykkap.com.

2.03 BASIS OF DESIGN -- SWINGING DOORS

A. Wide Stile, Not Thermally-Broken:
    1. Basis of Design: Kawneer Company, Inc; 500 Heavy Wall Entrances; www.kawneer.com.
    2. Other Acceptable Manufactures provided they meet or exceed the Basis of Design performance requirements:
        a. EFCO Corporation; Series D518 DuraStile; www.efcocorp.com.
        b. Oldcastle Building Envelope; Rugged Entrance Wide Stile Door and Frame; obe.com.
        c. Tubelite Inc; Monumental Doors; www.tubeliteinc.com.
        d. YKK AP America Inc; 50M Monumental Commercial Entrances; www.ykkap.com.

2.04 ALUMINUM-FRAMED STOREFRONT

A. Aluminum-Framed Storefront (ALSTOR-1): Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
    1. Glazing Rabbet: For 1 inch (25 mm) insulating glazing.
    2. Finish Color: Dark bronze.
    3. 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.
    4. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
    5. 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.
    6. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F (95 degrees C) over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
    7. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
    8. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
    9. Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly, primarily in line with inside pane of glazing and heel bead of glazing compound.
B. Performance Requirements
    1. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
        a. Design Wind Loads: Comply with requirements of applicable code.

b. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.

2. Water Penetration Resistance: No uncontrolled water on interior face, when tested in accordance with ASTM E331 at pressure differential of 10 psf (480 Pa).
3. Air Leakage: 0.06 cfm/sq ft (0.3 L/sec sq m) maximum leakage of storefront wall area when tested in accordance with ASTM E283/E283M at 1.57 psf (75 Pa) pressure difference.
4. Condensation Resistance Factor of Framing: 60, minimum, measured in accordance with AAMA 1503.
5. Overall U-value Including Glazing: 0.34 Btu/(hr sq ft deg F), maximum.

2.05 COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
   1. Framing members for interior applications need not be thermally broken.
   2. Glazing Stops: Flush.
   3. Cross-Section: As indicated on drawings.
   4. Structurally Reinforced Members: Extruded aluminum with internal reinforcement of structural steel member.

B. Glazing: See Section 08 8000.

C. Swing Doors: Glazed aluminum.
   1. Top Rail: 5 inches (127 mm) wide, nominal.
   2. Vertical Stiles: 5 inches (127 mm) wide, nominal.
   3. Bottom Rail: 10 inches (254 mm) wide.
   4. Glazing Stops: Square.
   5. Finish: Same as storefront.

2.06 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Structural Steel Sections: ASTM A36/A36M; galvanized in accordance with requirements of ASTM A123/A123M.

C. Fasteners: Stainless steel.

D. Exposed Flashings: Aluminum sheet, 20 gauge, 0.032 inch (0.81 mm) minimum thickness; finish to match framing members.

E. Concealed Flashings: Stainless steel, 26 gauge, 0.0187 inch (0.48 mm) minimum thickness.

F. Sill Flashing Sealant: Elastomeric, silicone or polyurethane, compatible with flashing material.

G. Sealant for Setting Thresholds: Non-curing butyl type.

H. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

I. Touch-Up Primer for Galvanized Steel Surfaces: SSPC-Paint 20, zinc rich.

2.07 FINISHES

A. Class I Color Anodized Finish: AAMA 611 AA-M12C22A42 Integrally colored anodic coating not less than 0.7 mils (0.018 mm) thick.

2.08 HARDWARE

A. For each door, include weatherstripping.

B. Other Door Hardware: See Section 08 7100.

C. Weatherstripping: Wool pile, continuous and replaceable; provide on all doors.

D. Automatic Door Operators and Actuators: See Section 08 4229.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.

B. Verify that storefront wall openings and adjoining water-resistive and/or air barrier seal materials are ready to receive work of this section.

3.02 INSTALLATION

A. Install wall system in accordance with manufacturer's instructions.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.

G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.

H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

I. Install glass and infill panels using glazing method required to achieve performance criteria; see Section 08 8000.

J. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inch per 3 feet (1.5 mm per m) non-cumulative or 0.06 inch per 10 feet (1.5 mm per 3 m), whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch (0.8 mm).

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for general testing and inspection requirements.

B. Repair or replace storefront components that have failed designated field testing, and retest to verify performance complies with specified requirements.

3.05 ADJUSTING

A. Adjust operating hardware and sash for smooth operation.

3.06 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, and take care to remove dirt from corners and to wipe surfaces clean.

C. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

3.07 PROTECTION

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

END OF SECTION

SECTION 08 4413 - GLAZED ALUMINUM CURTAIN WALLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum-framed curtain wall, with vision glazing and glass infill panels.

1.02 RELATED REQUIREMENTS

A. Section 07 2600 - Vapor Retarders: Sealing framing to water-resistive barrier installed on adjacent construction.

B. Section 08 8000 - Glazing.

1.03 REFERENCE STANDARDS

A. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site; 2015.

B. AAMA 501.4 - Recommended Static Test Method for Evaluating Window Wall, Curtain Wall and Storefront Systems Subjected to Seismic and Wind-Induced Inter-Story Drift; 2018.

C. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document); 2015.

D. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).

E. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.

F. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

G. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

H. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

I. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

J. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

K. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.

L. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.

M. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2016).

N. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.

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 SUBMITTALS

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

B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, internal drainage details, glazing, and infill.

C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work, expansion and contraction joint location and details, and field welding required.

D. Samples: Submit two samples 2 x 4 inches (51 x 102 mm) in size illustrating finished aluminum surface, glazing, infill panels, and glazing materials.

E. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.

F. Design Data: Provide framing member structural and physical characteristics and engineering calculations, and identify dimensional limitations; include load calculations at points of attachment to building structure.

G. Energy Performance Certification: For each glazed aluminum curtain wall system and glazing combination provide NFRC CMAST Bid Report. Coordinate with Section 08 8000.

H. Test Reports: Submit results of full-size mock-up testing. Reports of tests previously performed on the same design are acceptable.

I. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.

J. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Designer Qualifications: Design curtain wall and its structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed at the State in which the Project is located.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with not less than three years of experience.

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

1.07 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.

1.08 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C). Maintain this minimum temperature during and 48 hours after installation.

1.09 WARRANTY

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

B. Manufacturer Warranty: Provide 5-year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units. Complete forms in Owner's name and register with installer.

C. Finish Warranty: Provide 5-year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking. Complete forms in Owner's name and register with warrantor.

PART 2 PRODUCTS

2.01 PRODUCT REQUIREMENTS

A. Products listed as Basis of Design have been selected for specific criteria. Products from other manufacturer's listed herein, and/or substitutions will only be accepted if they meet, or exceed, the performance of the Basis of Design. Manufacturer must be able to provide documentation showing that the product meets, or exceeds, the Basis of Design.

2.02 BASIS OF DESIGN - CURTAIN WALL SYSTEMS

A. Pressure Cap at Verticals - SSG at Horizontals; Not Unitized, Field Assembled:
   1. Basis of Design: Kawneer 1600 System 1: www.kawneer.com.
   2. Other Acceptable Manufactures provided they meet or exceed the Basis of Design performance requirements:
      a. Boyd Aluminum: www.boydaluminum.com.
      b. EFCO: www.apogeearch.com.
      c. Oldcastle Building Envelope: www.obe.com.
      d. Tubelite, Inc: apogeearch.com.
      e. YKK AP America, Inc: www.ykkap.com.

2.03 CURTAIN WALL (ALCRTN-1)

A. Aluminum-Framed Curtain Wall: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
   1. Outside glazed, with pressure plate and mullion cover.
   2. Finish: Class I color anodized; Dark Bronze.
      a. Factory finish surfaces that will be exposed in completed assemblies.
      b. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
   3. Provide flush joints and corners, weathersealed, accurately fitted and secured; prepared to receive anchors; fasteners and attachments concealed from view; reinforced as required for imposed loads.
   4. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
   5. 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.
   6. Maintain continuous air barrier and/or vapor retarder seal throughout assembly, primarily in line with inside pane of glazing and inner sheet of infill panel and heel bead of glazing compound.
   7. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.

B. Structural Performance Requirements: Design and size components to withstand the following load requirements without damage or permanent set.
   1. Design Wind Loads: Comply with the requirements of ASCE 7
      a. Member Deflection: For spans less than 13 feet 6 inches (4115 mm), limit member deflection to flexure limit of glass in any direction, and maximum of 1/175 of span or 3/4 inch (19 mm), whichever is less and with full recovery of glazing materials.

b. Member Deflection: For spans over 13 feet 6 inches (4115 mm) and less than 40 feet (12.2 m), limit member deflection to flexure limit of glass in any direction, and maximum of 1/240 of span plus 1/4 inch (1/240 of span plus 6.4 mm), with full recovery of glazing materials.

2. Interstory Differential Lateral Movement: Meeting pass/fail criteria of AAMA 501.4 for Use Group I, Standard Occupancy, when tested at design displacement of 0.010 times greater adjacent story height, maximum, and 1.5 times design displacement, through three complete cycles.

3. Movement: Accommodate the following movement without damage to components or deterioration of seals:
   a. Expansion and contraction caused by 180 degrees F (82 degrees C) surface temperature.
   b. Expansion and contraction caused by cycling temperature range of 170 degrees F (77 degrees C) over a 12 hour period.
   c. Movement of curtain wall relative to perimeter framing.
   d. Deflection of structural support framing, under permanent and dynamic loads.

C. Water Penetration Resistance on Manufactured Assembly: No uncontrolled water on indoor face when tested as follows:
   1. Test Pressure Differential: 10 psf (480 Pa).
   2. Test Method: ASTM E331.

D. Air Leakage: 0.06 cfm/sq ft (0.3 L/sec sq m) maximum leakage of wall area when tested in accordance with ASTM E283/E283M at 6.24 psf (300 Pa) pressure difference across assembly.

E. Thermal Performance Requirements:
   1. Condensation Resistance Factor of Framing: 50, minimum, measured in accordance with AAMA 1503.
   2. Overall U-value Including Glazing: 0.36 Btu/(hr sq ft deg F), maximum.

2.04 COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
   1. Framing members for interior applications need not be thermally broken.
   2. Cross-Section: As indicated on drawings.
   3. Structurally Reinforced Members: Extruded aluminum with internal reinforcement of structural steel member.

B. Glazing: See Section 08 8000.

C. Sill Plate: Provide a subsill plate with integral front lip. Match finish of curtain wall system.

2.05 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Sheet Aluminum: ASTM B209/B209M.

C. Structural Steel Sections: ASTM A36/A36M; galvanized in accordance with requirements of ASTM A123/A123M.

D. Fasteners: Stainless steel; type as required or recommended by curtain wall manufacturer.

E. Exposed Flashings: Aluminum sheet, 20-gauge, 0.032-inch (0.81 mm) minimum thickness; finish to match framing members.

F. Concealed Flashings: Sheet aluminum, 26-gauge, 0.017-inch (0.43 mm) minimum thickness.

G. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

H. Glazing Accessories: See Section 08 8000.

I. Touch-Up Primer for Galvanized Steel Surfaces: SSPC-Paint 20, zinc rich.

2.06 FINISHES

A. Class I Color Anodized Finish: AAMA 611 AA-M12C22A42 Integrally colored anodic coating not less than 0.7 mils (0.018 mm) thick.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other related work.

B. Verify that curtain wall openings and adjoining water-resistive and air barrier seal materials are ready to receive work of this section.

C. Verify that anchorage devices have been properly installed and located.

3.02 INSTALLATION

A. Install curtain 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. Pressure Plate Framing: Install glazing and infill panels using exterior dry glazing method; see Section 08 8000.

H. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inch per 3 feet (1.5 mm/m) noncumulative or 0.5 inches per 100 feet (12 mm/30 m), whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch (0.8 mm).

C. Sealant Space Between Curtain Wall Mullions and Adjacent Construction: Maximum of 3/4 inch (19 mm) and minimum of 1/4 inch (6 mm).

3.04 FIELD QUALITY CONTROL

A. Provide services of curtain wall manufacturer's field representative to observe for proper installation of system and submit report.

B. See Section 01 4000 - Quality Requirements for general testing and inspection requirements.

C. Repair or replace curtain wall components that have failed designated field testing, and retest to verify performance complies with specified requirements.

3.05 ADJUSTING

A. Adjust operating hardware for smooth operation.

3.06 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, and wipe surfaces clean.

C. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

END OF SECTION

SECTION 08 5653 - SECURITY WINDOWS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Security transaction windows.

1.02 RELATED REQUIREMENTS

A. Section 07 9200 - Joint Sealants: Sealing joints between frames and adjacent construction.

1.03 REFERENCE STANDARDS

A. AAMA 611 - Specification for Anodized Architectural Aluminum; 2024.

B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

C. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.

1.04 SUBMITTALS

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

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Security Transaction Windows:

1. C.R. Laurence Co, Inc: www.crlaurence.com.
2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 SECURITY TRANSACTION WINDOWS

A. Security Transaction Windows: Aluminum 6063-T5 extruded aluminum lined with U.L. listed bullet resistant fiberglass for level 4.

1. Basis of Design: Interior Aluminum Bullet Resistant Sliding Transaction Window by C.R. Laurence Co, Inc.
2. Frame nominal width: 4 inch.
3. Finish: Satin Clear Anodized.
4. Location: Built within interior wall, as indicated on drawings.
5. Type of Use: As indicated on drawings.
6. Ballistic Resistance: Tested to meet UL 752, Level 4.
7. Glazing: Single (monolithic), clear, and ballistic resistant, level 3 in accordance with U.L. 752 testing standards. 1-1/4 inch laminated polycarbonate with abrasion resistant coating.

2.03 ASSEMBLY COMPONENTS

A. Glazing Seals: Factory installed; molded EPDM or neoprene compressible gaskets and compression strips.

B. Shelf: 2 inches thick, full window width, 12 inch minimum depth.

C. Deal Trays: Formed stainless steel, recessed into counter or sill for mounting under glazing frame, non-ricochet, Level 4 Bullet Resistant.

1. Basis of Design: Model BRT312 Deal Tray, C.R. Laurence Co, Inc.
2. Finish: Brushed Stainless Steel.

3. Size: 12 inches wide x 12 inches depth x 2 inches high Drop-In Deal Tray.

2.04 INSTALLATION

A. Install frames and glazing in accordance with manufacturer's printed instructions and recommendations. Repair damaged units as directed.

2.05 FINISHES

A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils (0.018 mm) thick.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that window openings are ready for installation of windows.
B. Notify Architect if conditions are not suitable for installation of windows; do not proceed until conditions are satisfactory.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions and drawing details.
B. Install windows in correct orientation (inside/outside or secure/non-secure).
C. Anchor windows securely in manner so as to achieve performance specified.
D. Set sill members and sill flashing in continuous bead of sealant.

3.03 ADJUSTING

A. Adjust operating components for smooth operation while also providing tight fit at contact points and a secure enclosure; lubricate operating hardware.

3.04 CLEANING

A. Clean exposed surfaces promptly after installation without damaging finishes.
B. Remove and replace defective work.

END OF SECTION

SECTION 08 7100 - DOOR HARDWARE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hardware for wood, aluminum, and hollow metal doors.
B. Electrically operated and controlled hardware.
C. Thresholds.
D. Weatherstripping and gasketing.

1.02 RELATED REQUIREMENTS

A. Section 08 1113 - Hollow Metal Doors and Frames.
B. Section 08 1416 - Flush Wood Doors.
C. Section 08 7113 - Power Door Operators.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
B. BHMA - Builders Hardware Manufacturers Association.
C. DHI (H&S) - Sequence and Format for the Hardware Schedule; 2019.
D. DHI (KSN) - Keying Systems and Nomenclature; 2019.
E. DHI (LOCS) - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames; 2004.
F. DHI WDHS.3 - Recommended Locations for Architectural Hardware for Flush Wood Doors; 1993; also in WDHS-1/WDHS-5 Series, 1996.
G. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.
H. ITS (DIR) - Directory of Listed Products; current edition.
I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
J. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2025.
K. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
L. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives; 2025.
M. UL (DIR) - Online Certifications Directory; Current Edition.
N. UL 1784 - Standard for Air Leakage Tests of Door Assemblies; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the manufacture, fabrication, and installation of products that door hardware is installed on.
B. Preinstallation Meeting: Convene a preinstallation meeting one week prior to commencing work of this section; attendance is required by affected installers and the following:
    1. Architect.
    2. Installer's Architectural Hardware Consultant (AHC).
    3. Hardware Installer.
    4. Owner's Security Consultant.

C. Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.

D. After receipt of approved hardware schedule, Hardware supplier shall initiate a meeting including the owner's representative to determine keying requirements. Upon completion of the 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 Conditions. Wiring diagrams shall be included in final submittals transmitted for distribution and field use.

1.05 SUBMITTALS

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

B. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project, and includes construction details, material descriptions, finishes, and dimensions and profiles of individual components.

C. Shop Drawings - Door Hardware Schedule: Submit detailed listing that includes each item of hardware to be installed on each door. Use door numbering scheme as included in Contract Documents.

1. Prepared by or under supervision of Architectural Hardware Consultant (AHC).
2. Comply with DHI (H&S) using door numbers and hardware set numbers as indicated in construction documents.
    a. Submit in vertical format.
3. List groups and suffixes in proper sequence.
4. Provide complete description for each door listed.
5. Provide manufacturer name, product names, and catalog numbers; include functions, types, styles, sizes and finishes of each item.
6. Include account of abbreviations and symbols used in schedule.

D. Shop Drawings - Electrified Door Hardware: Submit diagrams for power, signal, and control wiring for electrified door hardware that include details of interface with building safety and security systems. Provide elevations and diagrams for each electrified door opening as follows:

1. Prepared by or under supervision of Architectural Hardware Consultant (AHC) and Electrified Hardware Consultant (EHC).
2. Elevations: Submit front and back elevations of each door opening showing electrified devices with connections installed and an operations narrative describing how opening operates from either side at any given time.
3. Diagrams: Submit point-to-point wiring diagram that shows each device in door opening system with related colored wire connections to each device.

E. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

1. Submit manufacturer's parts lists and templates.
2. Bitting List: List of combinations as furnished.

F. Maintenance Materials and Tools: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Tools: One set of each special wrench or tool applicable for each different or special hardware component, whether supplied by hardware component manufacturer or not.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

B. 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.

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 insure 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 manufacturer to provide and support all computer managed locks and system components.

G. 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.

H. Installer Qualifications: Company specializing in performing work of the type specified for commercial door hardware with at least three years of documented experience.

I. Supplier Qualifications: Company with certified Architectural Hardware Consultant (AHC) to assist in work of this section.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Package hardware items individually; label and identify each package with door opening code to match door hardware schedule.

1.08 WARRANTY

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

B. Manufacturer's Warranty: Provide warranty against defects in material and workmanship for period indicated. Complete forms in Owner's name and register with manufacturer.

1. Closers: Ten years, minimum.
2. Exit Devices: Three years, minimum.
3. Locksets and Cylinders: Three years, minimum.
4. Other Hardware: Two years, minimum.

PART 2 PRODUCTS

2.01 DESIGN AND PERFORMANCE CRITERIA

A. Provide specified door hardware as required to make doors fully functional, compliant with applicable codes, and secure to extent indicated.

B. Provide individual items of single type, of same model, and by same manufacturer.

C. Provide door hardware products that comply with the following requirements:
   1. Applicable provisions of federal, state, and local codes.
   2. Accessibility: ADA Standards and ICC A117.1.
   3. Applicable provisions of NFPA 101.
   4. Hardware on Fire-Rated Doors: Listed and classified by UL (DIR), ITS (DIR), or testing firm acceptable to authorities having jurisdiction as suitable for application indicated.
   5. Hardware for Smoke and Draft Control Doors: Provide door hardware that complies with local codes, and requirements of assemblies tested in accordance with UL 1784.
   6. Listed and certified compliant with specified standards by BHMA (CPD).
   7. Hardware Preparation for Steel Doors and Steel Frames: BHMA A156.115.
   8. Hardware Preparation for Wood Doors with Wood or Steel Frames: BHMA A156.115W.
   9. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified.

D. Electrically Operated and/or Controlled Hardware: Provide necessary power supplies, power transfer hinges, relays, and interfaces as required for proper operation; provide wiring between hardware and control components and to building power connection in compliance with NFPA 70.

E. Fasteners:
   1. Provide fasteners of proper type, size, quantity, and finish that comply with commercially recognized standards for proposed applications.
      a. Aluminum fasteners are not permitted.
      b. Provide phillips flat-head screws with heads finished to match door surface hardware unless otherwise indicated.
   2. Fire-Rated Applications: Comply with NFPA 80.
      a. Provide wood or machine screws for hinges mortised to doors or frames, strike plates to frames, and closers to doors and frames.
      b. Provide steel through bolts for attachment of surface mounted closers, hinges, or exit devices to door panels unless proper door blocking is provided.
   3. Concealed Fasteners: Do not use through or sex bolt type fasteners on door panel sides indicated as concealed fastener locations, unless otherwise indicated.

2.02 MANUFACTURERS

A. Provide manufacturers, products, and product lines listed within this Section and as indicated in Section 08 7105 - Hardware Groups.

B. Substitutions: See Section 01 6000 - Product Requirements.

2.03 HINGES

A. Acceptable manufacturers and respective catalog numbers:
   1. Butt Hinges
      a. Standard Weight, Ball Bearing, Non-Ferrous:
         1) Ives: 5BB1
         2) Stanley: FBB191
         3) Hager: BB1191
         4) McKinney: TB2314
      b. Heavy Weight, Ball Bearing:
         1) Ives: 5BB1HW

2) Stanley: FBB168
3) Hager: BB1168
4) McKinney: T4B3786

c. Heavy Weight, Ball Bearing, Non-Ferrous:
1) Ives: 5BB1HW
2) Stanley: FBB199
3) Hager: BB1199
4) McKinney: T4B3386

2. Self Closing Hinges:
a. (0.134) Steel:
1) Bommer: LB4310
2) Hager: 1250
3) McKinney: 1502
4) Stanley: 2060R
5) Ives: 3SP1
6) PBB: RS81

b. (0.134) Stainless Steel:
1) Bommer: LB4390
2) Hager: 1150
3) McKinney: 1552
4) Stanley: 2060R
5) Ives: 3SP1
6) PBB: BB81

3. Continous Hinges:
a. Edge Mount Pin & Barrel Stainless Steel:
1) Ives: 700 Series
2) Markar: 300 Series
3) Stanley: 650 Series
4) McKinney: 300 Series

4. Power Transfers:
a. Concealed Ten-Wire:
1) Von Duprin: EPT-10
2) ASSA: CEPT-10

B. Hinges: Comply with BHMA A156.1, Grade 1.
1. Butt Hinges: Comply with BHMA A156.1 and BHMA A156.7 for templated hinges.
a. Provide hinge width required to clear surrounding trim.

2. Continuous Hinges: Comply with BHMA A156.26.
a. 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).
b. 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.
c. 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.
d. Each knuckle to be 2 inch, including split nylon bearing at each separation for quiet, smooth, self-lubricating operation.

e. Hinge to be able to carry Warnock Hersey Int. or UL for fire rated doors and frames up to 3 hours.
f. Provide machine screws for doors which have been reinforced to accept machine screws.
g. Note: Fire label for doors and frames should be placed on the header and top rail of fire rated doors and frames.

3. Provide hinges on every swinging door.
4. Provide five-knuckle full mortise butt hinges unless otherwise indicated.
5. Provide non-removable pins on exterior outswinging doors.
6. Provide power transfer hinges where electrified hardware is mounted in door leaf.
   a. Concealed power transfers shall be concealed in the door and frame when the door is closed.
   b. Concealed power transfers shall have a steel tube to protect wires from being cut.
   c. Concealed power transfers with spring tubes shall be rejected.
   d. Concealed power transfers shall be supplied with a mud box to house all terminations.
7. Unless otherwise specified, furnish hinges for exterior doors, fabricated from brass, bronze, or stainless steel. Unless otherwise specified, hinges for interior doors may be fabricated from steel.
8. Unless otherwise specified, furnish hinges in the following sizes:
   a. 4-1/2" x 4-1/2" 1-3/4" thick doors
9. Furnish hinges with sufficient width to accommodate trim and allow for 180-degree swing.
10. 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 interior doors.
11. Unless otherwise specified, furnish all hinges to template standards.
12. Unless otherwise specified, furnish hinge weight and type as follows:
    a. Standard weight: ball bearing hinge 5BB1 for interior opening 40 inches wide.
    b. Heavyweight: 4 ball bearing hinge 5BB1HW for interior openings over 40 inches wide, and for all vestibule doors.
    c. Heavyweight: 4 ball bearing hinge 5BB1HWss for exterior openings unless otherwise listed in groups.
13. Provide following quantity of butt hinges for each door:
    a. Doors up to 60 inches (1.5 m) High: Two hinges.
    b. Doors From 60 inches (1.5 m) High up to 90 inches (2.3 m) High: Three hinges.
    c. Doors 90 inches (2.3 m) High up to 120 inches (3 m) High: Four hinges.
    d. Doors over 42 inches wide: One additional hinge.

2.04 FLUSH BOLTS

A. Acceptable manufacturers and respective catalog numbers:
   1. Dust Proof Strike:
      a. Ives: DP2
      b. Door Controls: 80
      c. Hager: 280X
      d. Rockwood: 570
   2. Constant Latch Flush Bolt:
      a. Ives: FB51P/FB61P
      b. Door Controls: 805/905
      c. Hager: 293D/294D
      d. Rockwood: 2849/2949
   3. Automatic Flush Bolt:

a. Ives: FB31P/FB41P
b. Door Controls: 842/942
c. Hager: 291D/292D
d. Rockwood: 2842/2942

4. Manual Flush Bolt:
a. Ives: FB548
b. Door Controls: 780
c. Hager: 282D
d. Rockwood: 555

B. Flush Bolts: Comply with BHMA A156.16, Grade 1.
1. Flush Bolt Throw: 3/4 inch (19 mm), minimum.
2. Provide dustproof floor strike for bolt into floor, except at metal thresholds.
3. 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".
4. Self-Latching Flush Bolts: Automatically latch upon closing of door; manually retracted; located on inactive leaf of pair of doors.
5. 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.

2.05 EXIT DEVICES

A. Acceptable manufacturers and respective catalog numbers:
1. Wide Stile, Push Pad:
a. Von Duprin: 98/99 Series
b. Sargent: GL-43-80 Series
c. Detex: Advantex (Wide Stile)
2. Wide Stile, Electric Latch Retraction:
a. Von Duprin: QEL 98/99 Series
b. Sargent: GL-43-56-80 Series
c. Detex: Advantex-ER (Wide Stile)
3. Lever Trim/Pull Trim:
a. Von Duprin: 996/990 Series
b. Sargent: 740 ET/800 MAL
c. Detex: "D/DM" / "C" Trim

B. Exit Devices: Comply with BHMA A156.3, Grade 1.
1. Lever design to match lockset trim.
2. Provide cylinder with cylinder dogging or locking trim.
3. Provide exit devices properly sized for door width and height.
4. Provide strike as recommended by manufacturer for application indicated.
5. Provide less bottom rod (LBR) at scheduled locations to eliminate use of floor mounted strikes.
6. Provide UL (DIR) listed exit device assemblies for fire-rated doors and panic device assemblies for non-fire-rated doors.
7. Obtain exit devices from a single manufacturer, although several may be indicated as offering products complying with requirements.
8. Provide a sound-dampening feature to reduce touch pad return noise.
9. Quiet Electric Latch Retraction shall be accomplished using a motor driven assembly, and shall incorporate the following features:

a. Motor shall retract both the push pad assembly and latchbolt.
b. Automatic calibration of latch throw and pull.
c. Built-in time delay.
d. On-board installation and troubleshooting diagnostics built into power supply and device.
e. Retry mode if device does not pull on the first try.

10. Provide flush end caps to reduce potential damage from impact.
11. Provide dead-locking latch bolts to ensure security.
12. 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.
13. Coordinate with related trades to ensure adequate clearance and reinforcement is provided in doors and frames. Provide thru bolts as required.
14. Unless specific exit device dogging options are noted within hardware sets, provide dogging options as follows:
    a. Fire Rated devices: Dogging not permitted.
    b. Non-Rated Exit Only functions not equipped with outside trim or pull: Less Dogging.
    c. Non-Rated Classroom functions: Less Dogging.
    d. Non-Rated devices utilizing electric latch retraction or electrified outside trim: Less Dogging.
    e. All Other Non-Rated devices: Cylinder Dogging utilizing interchangeable core cylinders. Cylinder keyway shall match locksets furnished on this project.
15. Provide glass bead kits as required to accommodate door conditions. Screws shall not be visible through full glass doors.
16. Where specified, provide compatible keyed mullions with cylinder for pairs of doors.
17. Provide reinforced crossbars for all traditional style exit devices applied to doors over 36" wide.

2.06 ELECTRIC STRIKES

A. Acceptable manufacturers and respective catalog numbers:
   1. Von Duprin 6000 Series.
   2. HES 1006 Series.

B. Electric Strikes: Comply with BHMA A156.31, Grade 1.
   1. Provide UL (DIR) listed burglary-resistant electric strike; style to suit locks.
   2. Provide non-handed (verify voltage with electrical contractor) electric strike suitable for door frame material and scheduled lock configuration.
   3. Provide transformer and rectifier as necessary for complete installation.

2.07 LOCK CYLINDERS

A. Lock Cylinders: Provide key access on outside of each lock, unless otherwise indicated.
   1. Provide full size interchangeable core (FSIC) type cylinders, Grade 1, with six-pin core in compliance with BHMA A156.5 at locations indicated.
   2. Provide cams and/or tailpieces as required for locking devices.
   3. Within specific Door Sections, when provisions for lock cylinder are being referenced to this Section, provide specified lock cylinder and keyed to building keying system, unless otherwise indicated.

2.08 CYLINDRICAL LOCKS

A. Acceptable manufacturers and respective catalog numbers:
   1. Grade 1 Locks:

a. Schlage ND Series SPA
b. Sargent 10/11 Line LP
c. Corbin CL3100 PZD
d. Best 9K Series 14D

B. Cylindrical Locks (Bored): Comply with BHMA A156.2, Grade 1.
1. Bored Hole: 2-1/8 inch (54 mm) diameter.
2. Latchbolt Throw: 1/2 inch (12.7 mm), minimum.
3. Backset: 2-3/4 inch (70 mm) unless otherwise indicated.
4. Strikes: Provide manufacturer's standard strike for each latchset or lockset with strike box and curved lip extending to protect frame in compliance with indicated requirements.
a. Finish: To match lock or latch.
5. Provide guarded latch bolts for all locksets, and latch bolts with sufficient throw to maintain fire rating of both single and paired door assemblies.
6. Length of strike lip shall be sufficient to clear surrounding trim.
7. Provide wrought boxes for strikes at inactive doors, wood frames, and metal frames without integral mortar covers.

2.09 DOOR PULLS, PUSH PLATES AND PUSH BARS

A. Acceptable manufacturers and respective catalog numbers:
1. Offset Door Pull (1" dia. 10" ctc):
a. Burns 39C
b. Hager 12J
c. Rockwood BF157
d. Ives 8190-0
2. Offset Pull/Push Bar (1" dia. 10" ctc Pull):
a. Burns 422 x 39C
b. Hager 157
c. Rockwood BF15747
d. Ives 9190-0
3. Pull Plate (0.050" 6" x 16"):
a. Burns 56
b. Hager 30S 6 x 16
c. Rockwood 70E
d. Ives 8200 6" x 16"
4. Pull Plate (1" dia. 10" ctc - 0.050" x 4" x 16"):
a. Burns 5426C
b. Hager 34J 4 x 16
c. Rockwood 111 x 70C
d. Ives 8303-0 4" x 16"

B. Door Pulls, Push Plates, and Push Bars: Complying with BHMA A156.6.
1. Pull Type: Offset, unless otherwise indicated.
2. Push Plate Type: Flat, with square corners, unless otherwise indicated.
a. Edges: Beveled, unless otherwise indicated.
3. Bar Type: Push bar, unless otherwise indicated.
4. Material: Aluminum, unless otherwise indicated.

5. 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.
6. 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.

2.10 COORDINATORS

A. Acceptable manufacturers and respective catalog numbers:
   1. Bar Coordinator:
      a. Ives COR x FL
      b. Door Controls 600 x Filler
      c. Hager 297D x 297F
      d. Rockwood 2600 Series

B. Coordinators: Provide on doors having closers and self-latching or automatic flush bolts to ensure that inactive door leaf closes before active door leaf.
   1. Type: Bar, unless otherwise indicated.
   2. Material: Aluminum, unless otherwise indicated.
   3. Mounting Bracket: As required for application.
   4. Ensure that coordination of other door hardware affected by placement of coordinators and carry bar is applied properly for completely operable installation.

2.11 CLOSERS

A. Manufacturers; Surface Mounted:
   1. LCN, an Allegion brand; 4011/4111 EDA: www.allegion.com/us/#sle.
   2. Substitutions: See Section 01 6000 - Product Requirements.

B. Closers: Comply with BHMA A156.4, Grade 1.
   1. Type: Surface mounted to door.
   2. Obtain door closers from a single manufacturer, although several may be indicated as offering products complying with requirements.
   3. Provide extra heavy duty arm (EDA / HD) when closer is to be installed using parallel arm mounting.
   4. Hardware supplier shall coordinate with related trades to ensure aluminum frame profiles will accommodate specified door closers.
   5. Closers shall use high strength cast cylinders, forged main arms, and 1 piece forged steel pistons.
   6. Closers shall utilize a stable fluid withstanding temperature range of +120 deg F to -30 deg F without seasonal adjustment of closer speed to properly close the door. Closers for fire-rated doors shall be provided with temperature stabilizing fluid that complies with standards UL10C.
   7. Unless otherwise specified, all door closers shall have full covers and separate adjusting valves for sweeps, latch, and backcheck.
   8. Provide closers for all labeled doors. Provide closer series and type consistent with other closers for similar doors specified elsewhere on the project.
   9. 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.

10. Install closers on the room side of corridor doors, stair side of stairways and interior side of exterior doors.
11. Closers shall be furnished complete with all mounting brackets and cover plates as required by door and frame conditions, and by adjacent hardware.
12. 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.
13. Pressure Relief Valve, PRV, shall not be acceptable.

2.12 OVERHEAD STOPS AND HOLDERS

A. Acceptable manufacturers and respective catalog numbers:
   1. Surface Mount:
      a. Glynn-Johnson GJ900 Series
      b. Rixson 9 Series
      c. Sargent 590
   2. Concealed Mount:
      a. Glynn-Johnson GJ100 Series
      b. Rixson 1 Series
      c. Sargent 690

B. Overhead Stops and Holders (Door Checks): Comply with BHMA A156.8, Grade 1.
   1. Overhead stops (including slide block and end caps) shall be fabricated from metal.
   2. Unless otherwise specified, furnish GJ900 series overhead stop for doors equipped with regular arm surface type closers that swing more than 140 degrees before striking a wall, for doors that open against equipment, casework, sidelights, or other objects that would make wall bumpers inappropriate, and as specified in hardware groups.
   3. Furnish sex bolt attachments for wood and mineral core doors unless doors are supplied with proper reinforcing blocks.
   4. Provide special stop only (“SE” suffix) overhead stops when used in conjunction with electronic hold open closers.
   5. Do not provide holder function for labeled doors.

2.13 PROTECTION PLATES

A. Acceptable manufacturers and respective catalog numbers:
   1. Rockwood K1050
   2. Hager 190S
   3. Ives 8400
   4. Hiawatha J102

B. Protection Plates: Comply with BHMA A156.6.
   1. Where specified, provide 10" kick plates, 34" armor plates, and 4" mop plates. Unless otherwise specified, metal protective plates shall be .050" thick; plastic plates shall be 1/8" thick.
   2. Protective plates shall be 2" less door width, or 1" less door width at pairs. Protection plates over 16" shall not be provided for labeled doors unless specifically approved by door manufacturers listing.
   3. Where specified, provide surface mounted door edges. Edges shall butt to protective plates. Provide edges with cutouts as required adjacent hardware.

4. Adjust dimensions of protection plates to accommodate stile and rail dimensions, lite and louver cutouts, and adjacent hardware. Where required by adjacent hardware, protection plates shall be factory drilled for cylinders or other mortised hardware.

C. Metal Properties: Stainless steel.
   1. Metal, Standard Duty: Thickness 0.050 inch (1.27 mm), minimum.

D. Edges: Beveled, on four sides unless otherwise indicated.

E. Fasteners: Countersunk screw fasteners.

2.14 ELECTROMAGNETIC DOOR HOLDERS

A. Acceptable manufacturers and respective catalog numbers:
   1. LCN SEM 7800
   2. ABH 2000
   3. Edwards 1500

B. Electromagnetic Door Holders: Comply with BHMA A156.15.
   1. Type: Wall mounted, single unit, standard duty, with strike plate attached to door.
   2. Holding Force, Standard Duty: 35 lbs-force (155 N), minimum.
   3. Fail safe; door released to close automatically when electrical current is interrupted.
   4. Housing and armature shall be constructed of a die cast zinc material.
   5. Provide types as listed in groups.
   6. Where wall conditions do not permit the armature to reach the magnet, provide extensions.
   7. Provide proper voltage and power consumption as required by Division 26.
   8. Coordinate electrical requirements and mounting locations with other trades.
   9. Provide interface with fire detectors and fire-alarm system for fire-rated door assemblies.

2.15 WALL STOPS

A. Acceptable manufacturers and respective catalog numbers:
   1. Wrought Concave Wall Bumper:
      a. Ives WS406
      b. Hager 236W
      c. Burns 575
      d. Rockwood 409
   2. Automatic Wall Holder:
      a. Ives WS40
      b. Hager 326W
      c. Burns 533
      d. Rockwood 490

B. Wall Stops: Comply with BHMA A156.16, Grade 1 and Resilient Material Retention Test as described in this standard.
   1. Furnish a stop or holder for all doors. Furnish floor stops or hinge pin stops only where specifically specified.
   2. Where wall stops are not applicable, furnish overhead stops.
   3. Do not provide holder function for labeled doors.

2.16 THRESHOLDS

A. Acceptable manufacturers and respective catalog numbers:
   1. Zero 8655

2. Pemko 171
3. National Guard Products 425
4. Reese S205

B. Thresholds: Comply with BHMA A156.21.
1. Provide threshold at each exterior door, unless otherwise indicated.
2. Material: Aluminum.
3. Threshold Surface: Fluted horizontal grooves across full width.
4. Provide non-corroding fasteners at exterior locations.
5. Hardware supplier shall verify all finish floor conditions and coordinate proper threshold as required to insure a smooth transition between threshold and interior floor finish.
6. Threshold Types:
   a. 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.
   b. 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.

2.17 WEATHERSTRIPPING AND GASKETING

A. Acceptable manufacturers and respective catalog numbers:
1. Weatherstrip:
   a. Zero 429
   b. Pemko 2981_PK
   c. National Guard Products 700NA
   d. Reese 755
2. Adhesive Gasket:
   a. Zero 188S
   b. Pemko S88
   c. National Guard Products 5050
   d. Reese 797
3. Mullion Seal/Silencer
   a. Zero 8780
   b. Pemko 5110
   c. National Guard Products 5100N
4. Meeting Edge Seals:
   a. Zero 8193
   b. Pemko 18041
   c. National Guard Products 9605
   d. Reese 959
5. Automatic Door Bottom:
   a. Zero 355
   b. Pemko 42APKL
   c. National Guard Products 320N
   d. Reese 372A
6. Sweeps:
   a. Zero 8192
   b. Pemko 18061_NB

c. National Guard Products B606
d. Reese 964

7. Sweeps with Drip:
   a. Zero 8198
   b. Pemko 345_N
   c. National Guard Products C627
   d. Reese 354
8. Drip Cap:
   a. Zero 142
   b. Pemko 346
   c. National Guard Products 16
   d. Reese R201

B. Weatherstripping and Gasketing: Comply with BHMA A156.22.
   1. Head and Jamb Type: Adjustable.
   2. Door Sweep Type: Encased in retainer.
   3. Material: Aluminum, with brush weatherstripping.
   4. Provide gasketing (equal to Zero 188S) for smoke and draft control doors that complies with local codes, requirements of assemblies tested in accordance with UL 1784.
   5. Provide weatherstripping on each exterior door at head, jambs, and meeting stiles of door pairs, unless otherwise indicated.
   6. Provide door bottom sweep on each exterior door, unless otherwise indicated.

2.18 LATCH PROTECTOR

A. Latch Protector: Provide on door to protect latch from being tampered with while in locked position.
   1. Type: Standard latch protector.
   2. Material: Stainless steel.

2.19 KEY CONTROL SYSTEMS

A. Key Control Systems: Comply with guidelines of BHMA A156.28.
   1. Provide keying information in compliance with DHI (KSN) standards.
   2. Keying: Grand master keyed.
   3. Include control keying with removable core cylinders.
   4. Supply keys in following quantities:
      a. 1 each Grand Master keys.
      b. 2 each Control keys if new system.
      c. 2 each Change keys for each keyed core.
   5. Deliver keys with identifying tags to Owner by security shipment direct from hardware supplier.
   6. Permanent Keys and Cores: Stamped with applicable key marking for identification. Do not include actual key cuts within visual key control marks or codes. Stamp permanent keys "Do Not Duplicate."
   7. Owner or Owner's agent install permanent cores and return construction cores to hardware supplier. Construction cores and keys to remain property of hardware supplier.

2.20 KEY CABINET

A. Acceptable manufacturers and respective catalog numbers:
   1. Lund 1200-1205 AA
   2. Key Control M228-2480

3. Telkee RWC-AWC

B. Key Cabinet: Sheet steel construction, piano hinged door with key lock; BHMA A156.28.
   1. Mounting: Wall-mounted.
   2. Capacity: Actual quantity of keys, plus 50 percent additional capacity.
   3. Size key hooks to hold 6 keys each.
   4. Finish: Baked enamel, manufacturer's standard color.
   5. Key cabinet lock to building keying system.
   6. Furnish key cabinet complete with cam lock, permanent key tags, and change key cards.
   7. Hardware supplier shall prepare all key change index records, tag all keys and place permanent file keys in cabinet.

2.21 DOOR POSITION SWITCHES

A. Acceptable manufacturers and respective catalog numbers:
   1. Schlage Electronics 679 Series
   2. Sentrol 1076W
   3. Sargent 3287

2.22 POWER SUPPLY

A. Power Supply: Hard wired, with multiple zones providing eight (8) breakers for each output panel with individual control switches and LED's; UL (DIR) Class 2 listed.
   1. Operating Temperature: 32 to 110 degrees F (0 to 43 degrees C).
   2. 12/24 VDC Output, field selectable.
   3. Class 2 Rated power limited output.
   4. Universal 120-240 VAC input.
   5. Low voltage DC, regulated and filtered.
   6. Polarized connector for distribution boards.
   7. Fused primary input.
   8. AC input and DC output monitoring circuit w/LED indicators.
   9. Cover mounted AC Input indication.
   10. Tested and certified to meet UL294.
   11. NEMA 1 enclosure.
   12. Hinged cover w/lock down screws.
   13. High voltage protective cover.
   14. All electro-mechanical systems requiring fail safe circuits shall be capable of interfacing with the fire alarm system to cut power to appropriate system components. Unless already provided in another system component, all power supplies utilized in fail safe circuits shall include an integral relay which when connected to the N/C fire alarm contact will cut power to all openings connected to the individual power supply. Power supply, unless otherwise specified, will automatically reset itself when fire alarm relay returns to normal state following a fire alarm.

2.23 FINISHES

A. Finishes: Provide door hardware of same finish, unless otherwise indicated.
   1. Primary Finish: 626; satin chromium plated over nickel, with brass or bronze base material (former US equivalent US26D); BHMA A156.18.
   2. Secondary Finish: 630; satin stainless steel, with stainless steel 3000 series base material (former US equivalent US32D); BHMA A156.18.

a. Use secondary finish in kitchens, bathrooms, and other spaces containing chrome or stainless steel finished appliances, fittings, and equipment; provide primary finish on one side of door and secondary finish on other side if necessary.
b. Use secondary finish in exterior or high humidity locations.

3. Exceptions:
a. Where base material metal is specified to be different, provide finish that is an equivalent appearance in accordance with BHMA A156.18.
b. Door Closer Covers and Arms: Color as selected by Architect from manufacturer's standard colors unless otherwise indicated.
c. Aluminum Surface Trim and Gasket Housings: Anodized to match door panel finish, not other hardware, unless otherwise indicated.
d. Hardware for Aluminum Entrance Doors: Finished to match door panel finish, except at hand contact surfaces provide stainless steel with satin finish, unless otherwise indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that doors and frames are ready to receive this work; labeled, fire-rated doors and frames are properly installed, and dimensions are as indicated on shop drawings.

3.02 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions and applicable codes.
B. Install hardware for smoke and draft control doors in accordance with NFPA 105.
C. Use templates provided by hardware item manufacturer.
D. Door Hardware Mounting Heights: Distance from finished floor to center line of hardware item. As indicated in following list; unless noted otherwise in Door Hardware Schedule or on drawings.
1. For Steel Doors and Frames: Install in compliance with DHI (LOCS) recommendations.
2. For Wood Doors: Install in compliance with DHI WDHS.3 recommendations.
3. Mounting heights in compliance with ADA Standards:
a. Locksets: 40-5/16 inch (1024 mm).
b. Push Plates/Pull Bars: 42 inch (1067 mm).
c. Deadlocks (Deadbolts): 48 inch (1219 mm).
d. Exit Devices: 40-5/16 inch (1024 mm).
e. Door Viewer: 43 inch (1092 mm); standard height 60 inch (1524 mm).
E. Set exterior door thresholds with full-width bead of elastomeric sealant at each point of contact with floor providing a continuous weather seal; anchor thresholds with stainless steel countersunk screws.

3.03 ADJUSTING

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

3.04 CLEANING

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

3.05 PROTECTION

A. Protect finished Work under provisions of Section 01 7000 - Execution and Closeout Requirements.

B. Do not permit adjacent work to damage hardware or finish.

END OF SECTION

SECTION 08 7105 - HARDWARE GROUPS

HDWE GROUP 1.0

Qty		Description	Product Number	Manufacturer
		Hinges	As specified	IVE
1	EA	Passage Lockset	ND10S	SCH
1	EA	Wall Stop	WS406	IVE

Function:

Latch bolt by lever at all times.

HDWE GROUP 3.0

Qty		Description	Product Number	Manufacturer
		Hinges	As specified	IVE
1	EA	Classroom Lockset	ND70	SCH
1	EA	Wall Stop	WS406	IVE

Function:

Outside lever locked and unlocked by key. Inside lever always unlocked.

HDWE GROUP 3.2

Qty		Description	Product Number	Manufacturer
		Hinges	As specified	IVE
1	EA	Classroom Lockset	ND70	SCH
1	EA	Constant latch flushbolt	FB51T	IVE
2	EA	Wall Stop	WS406	IVE

Function:

Outside lever locked and unlocked by key. Inside lever always unlocked.

HDWE GROUP 4.0

Qty		Description	Product Number	Manufacturer
		Hinges	As specified	IVE
1	EA	Storeroom Lock	ND80	SCH
1	EA	Wall Stop	WS406	IVE

Function:

Outside lever fixed. Entrance by key only. Inside lever always unlocked.

HDWE GROUP 5.0

Qty		Description	Product Number	Manufacturer
		Hinges	As specified	IVE
1	EA	Entrance Lock	ND53	SCH
1	EA	Wall Stop	WS406	IVE

Function:

Turn/Push button locking; pushing and turning button locks outside lever requiring use of key until the button is manually unlocked. Push-button locking; pushing button locks outside lever until unlocked by key or by turning the inside lever.

HDWE GROUP 11.0

Qty		Description	Product Number	Manufacturer
		Hinges	As specified	IVE
1	EA	Passage lockset	ND10S	SCH
1	EA	Surface Closer	4011/4111 EDA with hold open	LCN
1	EA	Kick Plate	8400 10" x 2" LDW B4E	VON
1	EA	Wall Stop	WS406	IVE

Function:

Both levers always unlocked.

Note: Mount closer on the pull side of doors B157B and B159.

HDWE GROUP 11.4

Qty		Description	Product Number	Manufacturer
		Hinges	As specified	IVE
1	EA	Passage lockset	ND10S	SCH
1	EA	Surface Closer	4011/4111 EDA with hold open	LCN
1	EA	Wall Stop	WS406	IVE
1	EA	Armor plate	8400 34" x 2" LDW B4E	IVE
1	Set	Weatherstripping	429	ZER
1	EA	Door Sweep	8198	ZER
1	EA	Threshold	8655	ZER

Function:

Both levers always unlocked.

HDWE GROUP 12.0

Qty		Description	Product Number	Manufacturer
		Hinges	As specified	IVE
1	EA	Privacy Lock	ND40 with occupied indicator	SCH
1	EA	Surface Closer	4011/4111 EDA	LCN
1	EA	Kick Plate	8400 10" x 2" LDW B4E	IVE
1	EA	Wall Stop	WS406	IVE

Function:

Lever with emergency release recessed slot outside; push button in lever inside; springlatch; in unlocked state latch is retracted by either lever; outside lever is made inoperative by pushing button on inside lever; rotating inside lever retracts latch and releases button unlocking outside lever; closing door also unlocks preventing lockout; emergency unlock; an emergency key or small, flat screwdriver inserted in outside lever and turned releases button to unlock; inside lever always free for immediate egress.

HDWE GROUP 12.1

Qty		Description	Product Number	Manufacturer
		Hinges	As specified	IVE
1	EA	Privacy Lock	ND40 with occupied indicator	SCH
1	EA	Surface Closer	4011/4111 EDA	LCN
1	EA	Kick Plate	8400 10" x 2" LDW B4E	IVE
1	EA	Overhead stop	90S	IVE

Function:

Lever with emergency release recessed slot outside; push button in lever inside; springlatch; in unlocked state latch is retracted by either lever; outside lever is made inoperative by pushing button on inside lever; rotating inside lever retracts latch and releases button unlocking outside lever; closing door also unlocks preventing lockout; emergency unlock; an emergency key or small, flat screwdriver inserted in outside lever and turned releases button to unlock; inside lever always free for immediate egress.

HDWE GROUP 13.0

Qty		Description	Product Number	Manufacturer
		Hinges	As specified	IVE
1	EA	Classroom lock	ND70	SCH
1	EA	Surface Closer	4011/4111 EDA with hold open	LCN
1	EA	Wall Stop	WS406	IVE
1	EA	Kick Plate	8400 10" x 2" LDW B4E	IVE

Function:

Outside lever locked and unlocked by key. Inside lever always unlocked.

HDWE GROUP 13.2

Qty		Description	Product Number	Manufacturer
		Hinges	As specified	IVE
1	EA	Classroom lock	ND70	SCH
1	EA	Surface Closer	4011/4111 EDA with hold open	LCN
1	EA	Wall Stop	WS406	IVE
1	EA	Armor plate	8400 34" x 2" LDW B4E	IVE

Function:

Outside lever locked and unlocked by key. Inside lever always unlocked.

HDWE GROUP 13.3

Qty		Description	Product Number	Manufacturer
		Hinges	As specified	IVE
1	EA	Classroom lock	ND70	SCH
1	EA	Surface Closer	4011/4111 EDA with hold open	LCN
1	EA	Kick Plate	8400 10" x 2" LDW B4E	IVE

Function:

Outside lever locked and unlocked by key. Inside lever always unlocked.

HDWE GROUP 13.4

Qty		Description	Product Number	Manufacturer
		Hinges	As specified	IVE
1	EA	Classroom lock	ND70	SCH
1	EA	Surface Closer	4011/4111 EDA with hold open	LCN
1	EA	Wall Stop	WS406	IVE
1	EA	Armor plate	8400 34" x 2" LDW B4E	IVE
1	Set	Weatherstripping	429	ZER
1	EA	Door Sweep	8198	ZER
1	EA	Threshold	8655	ZER

Function:

Outside lever locked and unlocked by key. Inside lever always unlocked.

HDWE GROUP 13.5

Qty		Description	Product Number	Manufacturer
		Hinges	As specified	IVE
1	EA	Classroom lock	ND70	SCH
1	EA	Surface Closer	4011/4111 EDA with hold open	LCN
1	EA	Kick Plate	8400 10" x 2" LDW B4E	IVE
1	Set	Seals	188S	ZER

Function:

Outside lever locked and unlocked by key. Inside lever always unlocked.

HDWE GROUP 14.0

Qty		Description	Product Number	Manufacturer
		Hinges	As specified	IVE
1	EA	Storeroom Lockset	ND80	SCH
1	EA	Surface Closer	4011/4111 EDA with hold open	LCN
1	EA	Kick Plate	8400 10" x 2" LDW B4E	IVE
1	EA	Wall Stop	WS406	IVE

Function:

Latchbolt retracted by key outside or by lever inside. Outside lever always inoperative. Auxiliary latch deadlocks latchbolt when door is closed.

HDWE GROUP 14.2

Qty		Description	Product Number	Manufacturer
		Hinges	As specified	IVE
1	EA	Storeroom Lockset	ND80	SCH
1	EA	Surface Closer	4011/4111 EDA with hold open	LCN
1	EA	Kick Plate	8400 10" x 2" LDW B4E	IVE
1	EA	Wall Stop	WS406	IVE
1	Set	Seals	188S	ZER

Function:

Latchbolt retracted by key outside or by lever inside. Outside lever always inoperative. Auxiliary latch deadlocks latchbolt when door is closed.

HDWE GROUP 18.0

Qty		Description	Product Number	Manufacturer
		Hinges	As specified	IVE
1	EA	Storeroom lock	ND80	SCH
1	EA	Electric strike	6211 Fail secure	VON
1	EA	Surface Closer	4011/4111 EDA with hold open	LCN
1	EA	Kick Plate	8400 10" x 2" LDW B4E	IVE
1	EA	Wall Stop	WS406	IVE
1	EA	Card Reader	By Access Control Contractor	
1	EA	Door Contact	By Access Control Contractor	
1	EA	Power Supply	As required	
1	EA	Elevation drawing		
1	EA	Wire Diagram	Point to point	

Function:

Outside lever fixed. Entrance by key only. Inside lever always unlocked. Presentation of valid credential momentarily unlocks doors.

HDWE GROUP 18.1

Qty		Description	Product Number	Manufacturer
		Hinges	As specified	IVE
1	EA	Storeroom lock	ND80	SCH
1	EA	Electric strike	6211 Fail secure	VON
1	EA	Surface Closer	4011/4111 EDA with hold open	LCN
1	EA	Kick Plate	8400 10" x 2" LDW B4E	IVE
1	EA	Overhead stop	90S	GLY
1	EA	Card Reader	By Access Control Contractor	
1	EA	Door Contact	By Access Control Contractor	
1	EA	Power Supply	As required	
1	EA	Elevation drawing		
1	EA	Wire Diagram	Point to point	

Function:

Outside lever fixed. Entrance by key only. Inside lever always unlocked. Presentation of valid credential momentarily unlocks doors.

HDWE GROUP 18.5

Qty		Description	Product Number	Manufacturer
		Hinges	As specified	IVE
1	EA	Electric strike	6211 Fail secure	VON
1	EA	Storeroom lock	ND80	SCH
1	EA	Surface Closer	4011/4111 EDA	LCN
1	EA	Kick Plate	8400 10" x 2" LDW B4E	IVE

1	EA	Wall stop	WS406	IVE
1	Set	Weatherstripping	429	ZER
1	EA	Door Sweep	8198	ZER
1	EA	Threshold	8655	ZER
1	EA	Card Reader	By Access Control Contractor	
1	EA	Door Contact	By Access Control Contractor	
1	EA	Power Supply	As required	
1	EA	Elevation drawing		
1	EA	Wire Diagram	Point to point	

Function:

Outside lever fixed. Entrance by key only. Inside lever always unlocked. Presentation of valid credential momentarily unlocks doors.

HDWE GROUP 19.0

Qty		Description	Product Number	Manufacturer
		Hinges	As specified	IVE
1	EA	Push Plate	8200 6" x 16"	IVE
1	EA	Pull plate	8302 10" 4" x 16"	IVE
1	EA	Surface closer	4011/4111 EDA	LCN
1	EA	Kick Plate	8400 10" x 2" LDW B4E	IVE
1	EA	Wall Stop	WS406	IVE

Function:

Push/pull

HDWE GROUP 31.2

Qty		Description	Product Number	Manufacturer
		Hinges	As specified	IVE
1	EA	Fire exit hardware	99-L-BE-F	VON
1	EA	Surface Closer	4011/4111 EDA	LCN
1	EA	Kick Plate	8400 10" x 2" LDW B4E	IVE
1	Set	Seals	188S	ZER

Function:

Latchbolt retracted by depressing the actuation bar. Entrance by lever, always active, no cylinder.

HDWE GROUP 38.0

Qty		Description	Product Number	Manufacturer
		Hinges	As specified	IVE
1	EA	Panic hardware	99-NL-L-F	SCH
1	EA	Electric strike	6000 Series	VON
1	EA	Surface Closer	4011/4111 EDA with hold open	LCN
1	EA	Kick Plate	8400 10" x 2" LDW B4E	IVE
1	EA	Wall Stop	WS406	IVE
1	Set	Seals	188S	ZER

1	EA	Card Reader	By Access Control Contractor
1	EA	Door Contact	By Access Control Contractor
1	EA	Power Supply	As required
1	EA	Elevation drawing	
1	EA	Wire Diagram	Point to point

Function:

Latchbolt retracted inside by exit device push pad and outside by key in cylinder. Doors locks when key is removed and door is closed. Electric strike controlled by card reader.

HDWE GROUP 118.0

Qty		Description	Product Number	Manufacturer
		Hinges	As specified	IVE
1	EA	Power transfer	EPT10	VON
1	EA	Electric storeroom lock	ND80EU	SCH
1	EA	Lock guard	LG	IVE
1	EA	Surface Closer	4011/4111 EDA	LCN
1	EA	Kick Plate	8400 10" x 2" LDW B4E	IVE
1	EA	Overhead stop	90S	GLY
1	EA	Rain Drip	142	ZER
1	Set	Weatherstripping	429	ZER
1	EA	Door Sweep w/ Drip	8198	ZER
1	EA	Threshold	8655	ZER
1	EA	Card Reader	By Access Control Contractor	
1	EA	Door Contact	By Access Control Contractor	
1	EA	Power Supply	As required	
1	EA	Elevation drawing		
1	EA	Wire Diagram	Point to point	

Function:

Outside lever fixed. Entrance by key only. Inside lever always unlocked. Presentation of valid credential momentarily unlocks doors.

Note: Provide SRI coating on closer for Door B158A.

HDWE GROUP 138.0

Qty		Description	Product Number	Manufacturer
		Hinges	As specified	IVE
1	EA	Power Transfer	EPT10	VON
1	EA	Electric Panic Hardware	QEL+-99-NL-L	VON
1	EA	OH Stop	100S	GLY
1	EA	Surface Closer	4011/4111 EDA	LCN
1	EA	Rain Drip	142A	ZER
1	Set	Weather Strip	By Door Manufacturer	
1	EA	Door Sweep w/Drip	8198	ZER
1	EA	Threshold	8655	ZER
1	EA	Card Reader	By Access Control Contractor	
1	EA	Door Contact	By Access Control Contractor	
1	EA	Power Supply	As required	

1	EA	Elevation drawing	
1	EA	Wire Diagram	Point to Point

Function:

Latchbolt retracted inside by device push pad and outside by key in cylinder. Door locks when key is removed. Valid credential will momentarily unlock the door. Door relocks when card reader times out.

HDWE GROUP 238.0

Qty		Description	Product Number	Manufacturer
1	EA	Continuous hinge	700 x EPT	IVE
1	EA	Power Transfer	EPT10	VON
1	EA	Electric Panic Hardware	QEL+-99-NL-OP	VON
1	EA	Door pull, 1" round	8190 10"	IVE
1	EA	OH Stop	100S	GLY
1	EA	Surface Closer	4011/4111 EDA	LCN
1	EA	Card Reader	By Access Control Contractor	
1	EA	Door Contact	By Access Control Contractor	
1	EA	Power Supply	As required	
1	EA	Elevation drawing		
1	EA	Wire Diagram	Point to Point	

Function:

Latchbolt retracted inside by device push pad and outside by key in cylinder. Door locks when key is removed. Valid credential will momentarily unlock the door. Door relocks when card reader times out.

HDWE GROUP 334.0

Qty		Description	Product Number	Manufacturer
1	EA	Continuous hinge	700 x EPT	IVE
1	EA	Panic hardware	CD-99-NL-OP	VON
1	EA	Door pull, 1" round	8190 10"	IVE
1	EA	OH Stop	100S	GLY
1	EA	Surface Closer	4011/4111 EDA	LCN
1	EA	Rain Drip	142A	ZER
1	Set	Weather Strip	By Door Manufacturer	
1	EA	Door Sweep w/Drip	8198	ZER
1	EA	Threshold	8655	ZER

Function:

Latchbolt retracted inside by device push pad and outside by key in cylinder. Door locks when key is removed.

HDWE GROUP 338.0

Qty		Description	Product Number	Manufacturer
1	EA	Continuous hinge	700 x EPT	IVE
1	EA	Power Transfer	EPT10	VON

1	EA	Electric Panic Hardware	QEL+-99-NL-OP	VON
1	EA	Door pull, 1" round	8190 10"	IVE
1	EA	OH Stop	100S	GLY
1	EA	Surface Closer	4011/4111 EDA	LCN
1	EA	Rain Drip	142A	ZER
1	Set	Weather Strip	By Door Manufacturer	
1	EA	Door Sweep w/Drip	8198	ZER
1	EA	Threshold	8655	ZER
1	EA	Card Reader	By Access Control Contractor	
1	EA	Door Contact	By Access Control Contractor	
1	EA	Power Supply	As required	
1	EA	Elevation drawing		
1	EA	Wire Diagram	Point to Point	

Function:

Latchbolt retracted inside by device push pad and outside by key in cylinder. Door locks when key is removed. Valid credential will momentarily unlock the door. Door relocks when card reader times out.

END OF SECTION

SECTION 08 7113 - POWER DOOR OPERATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Operators for swinging doors.

B. Controllers, actuators, and safety devices.

1.02 RELATED REQUIREMENTS

A. Section 08 7100 - Door Hardware: Balance of door hardware.

1.03 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).

B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

C. BHMA A156.10 - Power Operated Pedestrian Doors; 2024.

D. BHMA A156.19 - Power Assist and Low Energy Power Operated Swinging Doors; 2019.

E. ITS (DIR) - Directory of Listed Products; current edition.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 SUBMITTALS

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

B. Shop Drawings:

1. Indicate layout and dimensions; head, jamb, and sill conditions; elevations; components, anchorage, recesses, materials, and finishes, electrical characteristics and connection requirements.
2. Identify installation tolerances required, assembly conditions, routing of service lines and conduit, and locations of operating components and boxes.

C. Product Data: Provide data on system components, sizes, features, and finishes.

D. Maintenance Data: Include manufacturer's parts list and maintenance instructions for each type of hardware and operating component.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Operators for Swinging Doors:

1. dormakaba; ED100 Series: www.dormakaba.com/#sle.
2. LCN, an Allegion brand; 4642: www.allegion.com/us/#sle.
3. NABCO Entrances Inc; GT 710 Low Energy (ADA) Automatic Door: www.nabcoentrances.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 POWER DOOR OPERATORS - GENERAL

A. Electrically Operated or Controlled Hardware: Provide necessary power supplies, relays, and interfaces as required for proper operation; provide wiring between control components and to building power connection in compliance with NFPA 70.

B. Comply with ADA Standards for egress requirements.

C. Comply with NFPA 101 and requirements of authorities having jurisdiction; provide units selected for actual door weight and for light pedestrian traffic unless otherwise indicated.

D. Exterior and Vestibule Doors: Provide equipment suitable for ambient operating temperature range of minus 20 to plus 140 degrees F (minus 29 to plus 60 degrees C).

E. Exterior Doors: Provide units capable of operating, closing, and holding doors closed under positive and negative differential pressure; if necessary, provide power closing.

F. Fire Door Operators: In addition to other requirements, provide equipment ITS (DIR) or UL (DIR) listed as a fire door operator with automatic closer.

G. System Integration: Integrate operator functionality with other systems as required for a complete working installation.

1. Provide time delay relay to signal automatic door operator to activate only after electric lock system is released.
2. Provide fire alarm interface configurable to safely open or close doors on signal from fire alarm system.
3. Provide controller output signals at the door closed or door open positions to facilitate interaction with security and access control systems.

2.03 OPERATORS FOR SWINGING DOORS

A. Door Operator: Pneumatic/Hydraulic.

1. Applications: Include operators for single and double doors.
2. Pneumatic/Hydraulic Operators: Low voltage control system, pneumatic activation to hydraulic device for opening and closing.
3. Speed Control: Variable, field-adjustable opening and closing cycles.
4. Functionality: Full-power open, spring close operation.
   a. Low-Energy Power Operators: Comply with BHMA A156.19; operator activated by pushing or pulling the door or by manual actuator, not a sensor; safeties not required.
5. Mounting: Surface mounted overhead.
6. Power Supply Units: Self-contained, electrically operated, and independent of door operator.
7. Actuators: See Section 08 7100.
8. Hold Open: Toggle switch at inside head of doors; deactivate hold-open on activation of fire alarm system, see Section 28 4600.

2.04 CONTROLLERS, ACTUATORS, AND SAFETY DEVICES

A. Controllers: Manufacturer's standard for products specified.

B. Safety Devices: Manufacturer's standard units recommended for project applications and conditions.

1. Comply with BHMA A156.10 for actuator and safety types and zones.

2.05 FINISHES

A. Aluminum Finishes: Manufacturer's standard.

1. Class I Natural Anodized Finish: Clear anodic coating; AAMA 611 AA-M12C22A41, minimum dry film thickness (DFT) of 0.7 mil, 0.0007 inch (0.018 mm).

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive work and dimensions are as indicated on shop drawings.

B. Verify that electric power is available, in the correct location, and of the correct characteristics.

3.02 INSTALLATION

A. Install equipment in accordance with manufacturer's instructions.

3.03 ADJUSTING

A. Adjust door equipment for correct function and smooth operation.

END OF SECTION

SECTION 08 8000 - GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Insulating glass units.
B. Glazing units.
C. Glazing compounds.

1.02 RELATED REQUIREMENTS

A. Section 07 2600 - Vapor Retarders.
B. Section 07 2700 - Air Barriers.

1.03 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.
B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015.
C. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2019).
D. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.
E. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2025.
F. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass; 2021a.
G. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2024.
H. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2019.
I. BS EN 14179-1 - Glass in Building - Heat Soaked Thermally Toughened Soda Lime Silicate Safety Glass - Part 1: Definition and Description; 2016.
J. GANA (GM) - GANA Glazing Manual; 2022.
K. GANA (SM) - GANA Sealant Manual; 2008.
L. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
M. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use; 1990 (2016).
N. ITS (DIR) - Directory of Listed Products; Current Edition.
O. NFRC 100 - Procedure for Determining Fenestration Product U-factors; 2023.
P. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence; 2023.
Q. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems; 2023.
R. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Product Data on Insulating Glass Unit and Glazing Unit Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.

D. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with GANA (GM), GANA (SM), GANA (LGRM), and IGMA TM-3000 for glazing installation methods.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

1.06 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 40 degrees F (4 degrees C).

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.07 WARRANTY

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

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

C. Heat Soaked Tempered Glass: Provide a five (5) year manufacturer warranty to include coverage for spontaneous breakage of fully tempered glass caused by nickel sulfide (NiS) inclusions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Float Glass Manufacturers:

1. Cardinal Glass Industries: www.cardinalcorp.com.
2. Guardian Glass, LLC: www.guardianglass.com.
3. Oldcastle Building Envelope: obe.com.
4. Vitro Architectural Glass (formerly PPG Glass): www.vitroglazings.com.
5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.

1. Design Pressure: Calculated in accordance with applicable codes.
2. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
3. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
4. Glass thicknesses listed are minimum.

B. Weather-Resistive Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure water-resistive barrier, vapor retarder, and/or air barrier.

1. In conjunction with weather barrier related materials described in other sections, as follows:
   a. Vapor Retarders: See Section 07 2600.
   b. Air Barriers: See Section 07 2700.

2. To utilize inner pane of multiple pane insulating glass units for continuity of vapor retarder and/or air barrier seal.
3. To maintain a continuous vapor retarder and/or air barrier throughout glazed assembly from glass pane to heel bead of glazing sealant.

C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 7 computer program.
2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 7 computer program.
3. Solar Optical Properties: Comply with NFRC 300 test method.

2.03 GLASS MATERIALS

A. Float Glass: Provide float glass based glazing unless otherwise indicated. All glazing shall be tempered as required by codes, and as required to meet thermal stress and wind loads.
1. Kind HS - Heat-Strengthened Type: Complies with ASTM C1048.
2. Kind FT - Fully Tempered Type: Complies with ASTM C1048.
3. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.
4. Heat-Soak Testing (HST): Provide HST of fully tempered glass used on all applications of project, to reduce risks of spontaneous breakage due to nickel sulfide (NiS) induced fractures in accordance with BS EN 14179-1.

2.04 INSULATING GLASS UNITS

A. Manufacturers:
1. Cardinal Glass Industries: www.cardinalcorp.com.
2. Guardian Glass, LLC: www.guardianglass.com.
3. Oldcastle Building Envelope: obe.com.
4. Pilkington North America Inc: www.pilkington.com.
5. Viracon: www.viracon.com.
6. Vitro Architectural Glass (formerly PPG Glass): www.vitroglazings.com.
7. Substitutions: See Section 01 6000 - Product Requirements.

B. Insulating Glass Units: Types as indicated.
1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
2. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
3. Warm-Edge Spacers: Flexible silicone with polyisobutylene (PIB) primary seal.
a. Spacer Width: As required for specified insulating glass unit.
4. Spacer Color: Black.
5. Edge Seal:
a. Dual-Sealed System: Provide polyisobutylene sealant as primary seal applied between spacer and glass panes, and silicone, polysulfide, or polyurethane sealant as secondary seal applied around perimeter.
6. Color: Black.

7. Purge interpane space with dry air, hermetically sealed.

C. Insulating Glass Units (INSUL GL-1): Vision glass, double glazed.
   1. Applications: Exterior glazing unless otherwise indicated.
   2. Space between lites filled with argon.
   3. Outboard Lite: Fully tempered float glass, 1/4 inch (6.4 mm) thick, minimum.
      a. Tint: Clear.
      b. Coating: Low-E (passive type), on #2 surface.
         1) Basis of Design:
            (a) Guardian Industries: SunGuard SNX 62/27.
            (b) Vitro Architectural Glass: Solarban 70.
            (c) Viracon: VNE1-63.
   4. Inboard Lite: Fully tempered float glass, 1/4 inch (6.4 mm) thick, minimum.
   5. Total Thickness: 1 inch (25.4 mm).
   6. Thermal Transmittance (U-Value)Winter - Center of Glass: 0.24, maximum.
   7. Visible Light Transmittance (VLT): 62 percent, minimum.
   8. Solar Heat Gain Coefficient (SHGC): 0.26, maximum.
   9. Visible Light Reflectance, Outside: 11 percent, minimum.
   10. Visible Light Reflectance, Inside: 12 percent, minimum.
   11. Glazing Method: Dry glazing method, gasket glazing.

D. Insulating Glass Units (INSUL GL-40): Spandrel glazing.
   1. Applications: Exterior spandrel glazing unless otherwise indicated.
   2. Space between lites filled with argon.
   3. Outboard Lite: Fully tempered float glass, 1/4 inch (6.4 mm) thick, minimum.
      a. Tint: Clear.
      b. Coating: Same as on vision units, on #2 surface.
   4. Inboard Lite: Fully tempered float glass, 1/4 inch (6.4 mm) thick.
      a. Tint: Clear.
      b. Opacifier: Ceramic frit, on #4 surface.
      c. Opacifier Color: As selected by Architect.
   5. Total Thickness: 1 inch (25.4 mm).

2.05 GLAZING UNITS

A. Monolithic Safety Glazing: Non-fire-rated.
   1. Applications: Interior glazing, unless otherwise indicated.
      a. Glazed lites in doors, except fire doors.
      b. Glazed sidelights to doors, except in fire-rated walls and partitions.
      c. Other locations required by applicable federal, state, and local codes and regulations.
      d. Other locations indicated on drawings.
   2. Glass Type: Fully tempered float glass.
   3. Tint: Clear.
   4. Glass Type: Fully tempered safety glass as specified.
      a. Thickness:
         1) (GL-1): 1/4 inch (6.4 mm), nominal.
   5. Tint: Clear.

2.06 GLAZING COMPOUNDS

A. Manufacturers:
   1. Bostik Inc: www.bostik-us.com.
   2. Dow Corning Corporation: www.dowcorning.com/construction.
   3. Momentive Performance Materials, Inc: www.momentive.com.
   4. Pecora Corporation: www.pecora.com.
   5. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
   6. Substitutions: See Section 01 6000 - Product Requirements.

2.07 ACCESSORIES

A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot (25 mm for each square meter) of glazing or minimum 4 inch (100 mm) by width of glazing rabbet space minus 1/16 inch (1.5 mm) by height to suit glazing method and pane weight and area.

B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Minimum 3 inch (75 mm) long by one half the height of the glazing stop by thickness to suit application, self adhesive on one face.

C. Glazing Splines: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.

B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

C. Verify that sealing between joints of glass framing members has been completed effectively.

D. Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION, GENERAL

A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.

B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.

C. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.

D. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.

E. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.

F. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, and paint.

3.04 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)

A. Application - Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building.

B. Place setting blocks at 1/4 points with edge block no more than 6 inch (152 mm) from corners.

C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.

D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.05 CLEANING

A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.

B. Remove non permanent labels immediately after glazing installation is complete.

C. Clean glass and adjacent surfaces after sealants are fully cured.

D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.06 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.

B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION

SECTION 08 8800 - SPECIAL FUNCTION GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Laminated security glazing units.

B. Insulating security glazing units.

1.02 RELATED REQUIREMENTS

A. Section 08 4313 - Aluminum-Framed Storefronts: Security glazing provided as part of storefront assembly.

1.03 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.

B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015.

C. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

D. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2019).

E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

F. ASTM C1036 - Standard Specification for Flat Glass; 2016.

G. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.

H. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2024.

I. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2025.

J. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass; 2021a.

K. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018.

L. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2024.

M. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2019.

N. ASTM F1233 - Standard Test Method for Security Glazing Materials And Systems; 2021.

O. ASTM F1642/F1642M - Standard Test Method for Glazing and Glazing Systems Subject to Airblast Loadings; 2017.

P. ASTM F1915 - Standard Test Methods for Glazing for Detention Facilities; 2005 (Reapproved 2025).

Q. ASTM F2248 - Standard Practice for Specifying an Equivalent 3-Second Duration Design Loading for Blast Resistant Glazing Fabricated with Laminated Glass; 2019.

R. GANA (GM) - GANA Glazing Manual; 2022.

S. GANA (SM) - GANA Sealant Manual; 2008.

T. GSA TS01 - Standard Test Method for Glazing and Window Systems Subject to Dynamic Overpressure Loadings; General Services Administration; 2003.

U. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use; 1990 (2016).

V. NFRC 100 - Procedure for Determining Fenestration Product U-factors; 2023.

W. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence; 2023.

X. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems; 2023.

Y. NGA (LGRM) - Laminated Glazing Reference Manual; 2019.

Z. UFC 4-010-01 - DoD Minimum Antiterrorism Standards for Buildings; 2018, with Editorial Revision (2024).

AA. UL 752 - Standard for Bullet-Resisting Equipment; Current Edition, Including All Revisions.

BB. UL 972 - Standard for Burglary Resisting Glazing Material; Current Edition, Including All Revisions.

1.04 SUBMITTALS

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

B. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, and special application requirements. Identify available colors.

C. Manufacturer's qualification statement.

D. Fabricator's qualification statement.

E. Executed warranty.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with GANA (GM), GANA (SM), IGMA TM-3000, and NGA (LGRM) for glazing installation methods. Maintain one copy on site.

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

C. Fabricator Qualifications: Certified by glass manufacturer for type of glass, coating, and treatment involved and capable of providing specified warranty.

1.06 WARRANTY

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

B. Polycarbonate Glazing: Provide 5-year manufacturer warranty to include coverage for breakage, coating failure, abrasion resistance, including providing products to replace failed units.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Security Glass Manufacturers:

1. Total Security Solutions: www.security.tssbulletproof.com.
2. PRL Glass Systems: www.prlglass.com.
3. Armormax: www.armormax.com.
4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING

A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.

1. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
2. Provide glass edge support system sufficiently stiff to limit lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
3. Glass thicknesses listed are minimum.

B. Weather-Resistive Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure.
   1. Coordinate with weather-barrier-related materials described in other sections, as follows:
C. Thermal and Optical Performance: Provide exterior glazing products with performance properties in accordance with manufacturer's published data as determined by the following procedures:
   1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW computer program.
   2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW computer program.
   3. Solar Optical Properties: Comply with NFRC 300 test method.

2.03 LAMINATED SECURITY GLAZING UNITS (SEC GL-1)

A. Security Glazing: Laminated glass and polycarbonate, multi-ply; ASTM C1349.
   1. Applications: Locations as indicated on drawings.
   2. Tint: Clear and obsecure, as indicated on drawings.
   3. Thickness: As required to meet performance criteria.
   4. Outer Lite: Heat-strengthened glass.
   5. Interlayer, Outboard Side: Thermoplastic urethane (TPU), thickness as required to meet performance criteria.
   6. Outer Middle Lite: Tempered glass.
   7. Interlayer, Middle Layer: Thermoplastic urethane (TPU), thickness as required to meet performance criteria.
   8. Inner Middle Lite: Tempered glass.
   9. Interlayer, Inboard Side: Thermoplastic urethane (TPU), thickness as required to meet performance criteria.
   10. Inside Lite: Polycarbonate.
   11. Performance Criteria:
      a. Bullet Resistance: Pass UL 752 tests to comply with Level 4: 30 caliber rifle, partial copper jacket lead core soft point ballistic criteria and weapon description.
   12. Glazing Method: As required to meet performance criteria.
   13. Frame: Extruded aluminum frame.

2.04 INSULATING SECURITY GLAZING UNITS (INSUL SEC GL-1)

A. Insulating Glass Units:
   1. Durability: Certified by independent testing agency to comply with ASTM E2190.
   2. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic or magnetic sputter vapor deposition coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
   3. Spacer Color: Black.
   4. Edge Seal:
      a. Color: Black.
   5. Purge interpane space with dry air, hermetically sealed.

2.05 ACCESSORIES

A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot (25 mm for each square meter) of glazing or minimum 4-inch (100 mm) width

of glazing rabbet space minus 1/16-inch (1.5 mm) height to suit glazing method and pane weight and area.

B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Minimum 3 inches (75 mm) long by one-half height of glazing stop by thickness to suit application; self-adhesive on one face.

C. Glazing Tape, Back-Bedding Mastic: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod for application indicated; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black color.

2.06 SOURCE QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for additional requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.

B. Verify that surfaces of glazing channels or recesses are clean and free of obstructions that impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

3.02 PREPARATION

A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.

B. Seal porous glazing channels or recesses with substrate-compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION, GENERAL

A. Install glazing in accordance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.

B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.

3.04 INSTALLATION - DRY GLAZING METHOD, GASKET GLAZING

A. Application: Set glazing infills from either exterior or interior of building.

B. Place setting blocks at 1/4 points with edge block no more than 6 inches (152 mm) from corners.

C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.

D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.05 INSTALLATION - WET GLAZING METHOD, SEALANT AND SEALANT

A. Application - Exterior Glazed: Set glazing infills from exterior of building.

B. Place setting blocks at 1/4 points and install glazing pane or unit.

C. Install removable stops with glazing centered in space by inserting spacer shims on both sides at 24-inch (610 mm) intervals, 1/4 inch (6.4 mm) below sight line.

D. Apply sealant to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

3.06 INSTALLATION - WET/DRY GLAZING METHOD, TAPE AND SEALANT

A. Application - Interior Glazed: Set glazing infills from interior of building.

B. Cut glazing tape to length and install against permanent stops, projecting 1/16 inch (1.6 mm) above sight line.
C. Place setting blocks at 1/4 points with edge block no more than 6 inches (152 mm) from corners.
D. Rest glazing on setting blocks and push against tape to ensure full contact at perimeter of pane or unit.
E. Install removable stops with spacer shims inserted between glazing and applied stops at 24-inch (610 mm) intervals, 1/4 inch (6 mm) below sight line.
F. Carefully trim protruding tape with knife.

3.07 INSTALLATION - BUTT JOINT GLAZING METHOD, SEALANT ONLY

A. Application - Exterior Glazed: Set glazing infills from exterior side of building.
B. Temporarily brace glass in position for duration of glazing process; mask edges of glass at adjoining glass edges and between glass edges and framing members.
C. Temporarily secure small-diameter nonadhering foamed rod on back side of joint.
D. Apply sealant to open side of joint in continuous operation; thoroughly fill joint without displacing foam rod, and then tool sealant surface smooth to concave profile.
E. Permit sealant to cure, remove foam backer rod, apply sealant to opposite side, and tool smooth to concave profile.
F. Remove masking tape.

3.08 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for additional requirements.
B. Glass and Glazing: Product manufacturers provide field surveillance of installation of their products.
C. Monitor and report installation procedures and unacceptable conditions.

3.09 CLEANING

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

3.10 PROTECTION

A. After installation, mark pane with 'X' using removable plastic tape or paste.
B. Remove and replace glass damaged during construction period prior to Date of Substantial Completion.

END OF SECTION

SECTION 08 8813 - FIRE-RATED GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire-rated glazing units.

B. Glazing compounds.

1.02 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.

B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015 (Reaffirmed 2020).

C. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

D. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2019).

E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018 (Reapproved 2024).

F. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.

G. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2025.

H. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2024.

I. GANA (GM) - GANA Glazing Manual; 2022.

J. GANA (SM) - GANA Sealant Manual; 2008.

K. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use; 1990 (2016).

M. ITS (DIR) - Directory of Listed Products; Current Edition.

N. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2022.

O. NFPA 257 - Standard on Fire Test for Window and Glass Block Assemblies; 2022.

P. NFRC 100 - Procedure for Determining Fenestration Product U-factors; 2023.

Q. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence; 2023.

R. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems; 2023.

S. UL (DIR) - Online Certifications Directory; Current Edition.

T. UL 9 - Standard for Fire Tests of Window Assemblies; Current Edition, Including All Revisions.

U. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

V. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.03 SUBMITTALS

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

B. Product Data on Glazing Unit Glazing Types: Provide structural, physical, and environmental characteristics, size limitations, special handling and installation requirements.

C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.

1.04 QUALITY ASSURANCE

A. Perform work in accordance with GANA (GM), GANA (SM), GANA (LGRM), and IGMA TM-3000 for glazing installation methods.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Float Glass Manufacturers:
   1. Cardinal Glass Industries: www.cardinalcorp.com.
   2. Guardian Glass, LLC: www.guardianglass.com.
   3. Pilkington North America Inc: www.pilkington.com.
   4. Vitro Architectural Glass (formerly PPG Glass): www.vitroglazings.com.
   5. Substitutions: See Section 01 6000 - Product Requirements.

B. Fire-Protection-Rated Glass:
   1. Manufacturers:
      a. SAFTIFIRST, a division of O'Keeffe's Inc: www.safti.com.
      b. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads and withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
   1. Design Pressure: Calculated in accordance with ASCE 7.
   2. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
   3. Provide glass edge support system sufficiently stiff to limit lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
   4. Glass thicknesses listed are minimum.

B. Vapor Retarder and Air Barrier Seals: Provide completed assemblies that maintain building enclosure vapor retarder and air barrier continuity.
   1. Maintain continuous vapor retarder and air barrier throughout glazed assembly from glass pane to heel bead of glazing sealant.

C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated, in accordance with manufacturer's published data as determined with the following procedures or test methods:
   1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW software.
   2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW software.
   3. Solar Optical Properties: Comply with NFRC 300 test method.

D. Fully Tempered Safety Glass: Comply with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.

2.03 GLASS MATERIALS

A. Float Glass: Provide float glass based glazing unless otherwise indicated.
   1. Kind FT - Fully Tempered Type: Comply with ASTM C1048.
   2. Impact-Resistant Safety Glass: Comply with ANSI Z97.1 - Class B, or 16 CFR 1201 - Category I criteria.

2.04 GLAZING UNITS

A. Fire-Protection-Rated Glazing (FR GL-1): Type, thickness, and configuration of glazing that contains flame, smoke, and does not block radiant heat, as required to achieve indicated fire rating period as indicated on drawings.
   1. Provide products listed by ITS (DIR) or UL (DIR) and approved by authorities having jurisdiction.
   2. Safety Glazing Certification: 16 CFR 1201 Category II.
   3. Glazing Method: As required for fire rating.
   4. Fire-Rating Period: As indicated on drawings.
   5. Markings for Fire-Protection-Rated Glazing Assemblies: Provide permanent markings on fire-protection-rated glazing in compliance with ICC (IBC), local building code, and authorities having jurisdiction
      a. "D" - meets fire door assembly criteria of NFPA 252, UL 10B, or UL 10C fire test standards.
      b. "OH" - meets fire window assembly criteria, including hose stream test of NFPA 257 or UL 9 fire test standards.
      c. "H" - meets fire door assembly hose stream test of NFPA 252, UL 10B, or UL 10C fire tests standards.
      d. "XXX" - placeholder that represents fire-rating period, in minutes.

2.05 GLAZING COMPOUNDS

A. Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; nonbleeding, nonstaining; 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.

2.06 ACCESSORIES

A. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Continuous by one half the height of glazing stop by thickness to suit application, self adhesive on one face.
B. Glazing Tape: Flexible tape made from spun calcium-magnesium-silica fibers in binder; designed to remain stable at temperatures up to 2,012 degrees F (1,100 degrees C).
   1. Thickness: As recommended by framing manufacturer for glazing application.
C. Glazing Gaskets: Flexible intumescent seals.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.
B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.
C. Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.
B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION - GENERAL

A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers unless more stringent requirements are indicated, including those in referenced glazing standards.
B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.
C. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.
D. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.
E. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.
F. Prevent glass from contact with contaminating substances that may result from construction operations including, but not limited to weld spatter, fire-safing, plastering, mortar droppings, etc.

3.04 CLEANING

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

3.05 PROTECTION

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

END OF SECTION

SECTION 09 2116 - GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Performance criteria for gypsum board assemblies.
B. Metal stud wall framing.
C. Metal channel ceiling framing.
D. Acoustic insulation.
E. Gypsum sheathing.
F. Gypsum wallboard.
G. Joint treatment and accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 2600 - Vapor Retarders: Vapor-impermeable membranes.
B. Section 07 8400 - Firestopping: Top-of-wall assemblies at fire-resistance-rated walls.
C. Section 07 9200 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

1.03 REFERENCE STANDARDS

A. AISI S220 - North American Standard for Cold-Formed Steel Nonstructural Framing; 2020.
B. AISI S240 - North American Standard for Cold-Formed Steel Structural Framing; 2015, with Errata (2020).
C. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members; 2015.
D. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2020 (Reapproved 2024).
E. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017 (Reapproved 2022).
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; 2024.
H. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2019.
I. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2024.
J. ASTM C1280 - Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing; 2018 (Reapproved 2023).
K. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2024.
L. GA-216 - Application and Finishing of Gypsum Panel Products; 2024.
M. GA-600 - Fire Resistance and Sound Control Design Manual; 2024.
N. UL (FRD) - Fire Resistance Directory; Current Edition.

1.04 SUBMITTALS

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

B. Product Data: Provide data on metal framing, gypsum board, glass mat faced gypsum board, accessories, and joint finishing system.

PART 2 PRODUCTS

2.01 PRODUCT REQUIREMENTS

A. Products listed as Basis of Design have been selected for specific criteria. Products from other manufacturer's listed herein, and/or substitutions will only be accepted if they meet, or exceed, the performance of the Basis of Design. Manufacturer must be able to provide documentation showing that the product meets, or exceeds, the Basis of Design.

2.02 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.

B. Fire-Resistance-Rated Assemblies: Provide completed assemblies with the following characteristics:

1. Gypsum Association File Numbers: Comply with requirements of GA-234 and GA-600 for the particular assembly.
2. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL (FRD).

2.03 METAL FRAMING MATERIALS

A. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S220 or equivalent.

B. Basis of Design: ClarkDietrich; www.clarkdietrich.com.

C. Other Acceptable Manufactures provided they meet or exceed the Basis of Design performance requirements - Metal Framing, Connectors, and Accessories:

1. MarinoWARE: www.marinoware.com/#sle.
2. SCAFCO Corporation: www.scafco.com.
3. Steel Construction Systems: www.steelconsystems.com.
4. Substitutions: See Section 01 6000 - Product Requirements.

D. Nonstructural Framing System Components: AISI S220; 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/120 at 5 psf (L/120 at 240 Pa).

1. Provide minimum CP 90 corrosion protection where installed in exterior applications and humid environments.
2. Studs: "C" shaped with flat or formed webs with knurled faces.
    a. (MET STUD-2): Provide 20 gauge studs unless noted otherwise.
3. Runners: U shaped, sized to match studs.
4. Furring Members (FUR-1): Hat-shaped sections, minimum depth of 7/8 inch (22 mm).

E. Resilient Furring Channels (FUR-4): 1/2 inch (12 mm) depth, for attachment to substrate through one leg only.

1. Products:
    a. Same manufacturer as other framing materials.
    b. ClarkDietrich; RC Deluxe Resilient Channel: www.clarkdietrich.com.
    c. Substitutions: See Section 01 6000 - Product Requirements.

F. Shaft Wall Studs and Accessories: AISI S220; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 and specified performance requirements.

1. C-H Studs (MET STUD-5): Gauge as required by UL listing.

G. Thermal Sub-Framing Spacer (FUR-5): Pultruded fiber glass and thermoset resin insulation clip.
   1. Spacer Thickness: 3/16 inches, nominal.
   2. Spacer Depth: As indicated in drawings. Provide manufacturer's recommended corrosion resistant fasteners.
   3. Provide 'Z' furring channels as indicated on the drawings and as specified above.
   4. Basis of Design:
      a. Advanced Architectural Products SMARTci Systems: GreenGirt-Simple Z; www.smartcisystems.com.
      b. Cascadia Windows, Inc: Cascadia Clip; www.cascadiaclip.com.
      c. exoGIRT; www.exo-girt.com.
      d. Knight Wall Systems: KWS MFI System Cladding Attachment; knightwallsystems.com.
      e. Northern Facades; ISO Clip: www.northernfacades.com.
      f. Strongwell: Strongirt; www.strongirt.com.
      g. Substitutions: See Section 01 6000 - Product Requirements.

2.04 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
   1. CertainTeed Corporation: www.certainteed.com/.
   2. Georgia-Pacific Gypsum: www.gpgypsum.com.
   3. Gold Bond Building Products, LLC provided by National Gypsum Company: www.goldbondbuilding.com.
   4. USG Corporation: www.usg.com.
   5. Substitutions: See Section 01 6000 - 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. Material ID:
      a. (GYP BD-1): 5/8 inch Type X.
   2. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
   3. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
   4. Basis of Design: USG Corporation; Sheetrock Brand EcoSmart Gypsum Panels: www.usg.com.
   5. Other Acceptable Paper-Faced Products provided they meet or exceed the Basis of Design performance requirements:
      a. CertainTeed Corporation; Type X Drywall: www.certainteed.com.
      b. Georgia-Pacific Gypsum; ToughRock: www.gpgypsum.com.
      c. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond Fire-Shield Gypsum Board: www.goldbondbuilding.com.
      d. Substitutions: See Section 01 6000 - Product Requirements.

C. 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. Type X Thickness (GYP BD-6): 5/8 inch (16 mm).
   3. Edges: Tapered.
   4. Basis of Design: USG Corporation; Sheetrock Brand Mold Tough EcoSmart.
   5. Other Acceptable Products provided they meet or exceed the Basis of Design performance requirements:

a. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond XP Fire-Shield Gypsum Board: www.goldbondbuilding.com/#sle.
b. Substitutions: See Section 01 6000 - Product Requirements.

D. Exterior Sheathing Board: Sizes to minimize joints in place; ends square cut.
1. Application: Exterior sheathing, unless otherwise indicated.
2. Glass Mat Faced Sheathing: Glass mat faced gypsum substrate as defined in ASTM C1177/C1177M.
3. Core Type: Type X.
4. Type X Thickness (GYP SHTG-2): 5/8 inch (16 mm).
5. Edges: Square.
6. Basis of Design: USG Corporation; Securerock Brand Ultralight Glass-Mat Sheathing: www.usg.com.
7. Other Acceptable Products provided they meet or exceed the Basis of Design performance requirements:
a. CertainTeed Corporation; GlasRoc Type X Exterior Sheathing: www.certainteed.com.
b. Georgia-Pacific Gypsum; DensGlass Sheathing: www.gpgypsum.com.
c. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond eXP Fire-Shield Sheathing: www.goldbondbuilding.com.
d. Substitutions: See Section 01 6000 - Product Requirements.

E. Shaftwall and Coreboard (GYP BD-20): Type X; 1 inch (25 mm) thick by 24 inches (610 mm) wide, beveled long edges, ends square cut.
1. Paper-Faced Type: Gypsum shaftliner board or gypsum coreboard as defined ASTM C1396/C1396M; water-resistant faces.
2. Basis of Design: USG Corporation; Sheetrock Brand Glass-Mat Liner Panels Mold Tough: www.usg.com.
3. Other Acceptable Products provided they meet or exceed the Basis of Design performance requirements:
a. CertainTeed Corporation; GlasRoc Shaftliner Type X: www.certainteed.com.
b. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond eXP Shaftliner: www.goldbondbuilding.com.
c. Substitutions: See Section 01 6000 - Product Requirements.

2.05 GYPSUM BOARD ACCESSORIES

A. Acoustic Insulation (INSUL-80): ASTM C665; preformed fiber glass or mineral fiber, friction fit type, unfaced. Thickness: 3-1/2 inch (84 mm), minimum. Insulation should fill the cavity.
1. Basis of Design: Owens Corning Unfaced Ecotouch Insulation.
a. Other Acceptable Products provided they meet or exceed the Basis of Design performance requirements.

B. (INSUL-81) Sound Attenuation Fire Batts (SAFB): ASTM C423; performed mineral fiber, friction fit type, unfaced. Thickness: As indicated in the drawings or to fill the cavity unless noted otherwise.
1. Basis of Design: Johns Manville SAFB.

C. Backing Plate (MET BLKG-1): Metal backing plate. 20 gauge. Width and length as required for application.

D. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.

E. Vapor Retarder: See Section 07 2600.

F. Finishing Accessories: ASTM C1047, extruded aluminum alloy (6063 T5) or galvanized steel sheet ASTM A924/A924M G90, unless noted otherwise.

1. Types: As detailed or required for finished appearance.

G. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.

1. Tape: 2 inch (50 mm) wide, coated glass fiber tape for joints and corners.
2. Tape: 2 inch (50 mm) wide, creased paper tape for joints and corners.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 SHAFT WALL INSTALLATION

A. Shaft Wall Framing: Install in accordance with GA-600 requirements.

1. Fasten runners to structure with short leg to finished side, using appropriate power-driven fasteners at not more than 24 inches (600 mm) on center.

B. Shaft Wall Liner: Cut panels to accurate dimensions and install sequentially between special friction studs.

1. On walls over sixteen feet high, screw-attach studs to runners top and bottom.
2. Seal perimeter of shaft wall and penetrations with acoustical sealant.

3.03 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C1007AISI S220 and manufacturer's instructions.

B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.

C. Studs: Space studs at 16 inches on center (at 406 mm on center).

1. Extend partition framing to structure where indicated and to ceiling in other locations.
2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.

D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.

E. Standard Wall Furring: Install at concrete walls scheduled to receive gypsum board, not more than 4 inches (100 mm) from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 24 inches (600 mm) on center.

F. Acoustic Furring: Install resilient channels at maximum 24 inches (600 mm) on center. Locate joints over framing members.

G. Furring for Fire-Resistance Ratings: Install as required for fire-resistance ratings indicated and to GA-600 requirements.

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 continuous bead at perimeter of each layer of gypsum board.
2. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

3.05 BOARD INSTALLATION

A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Single-Layer Nonrated: 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-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

D. Exterior Sheathing: Comply with ASTM C1280. Install sheathing vertically, with edges butted tight and ends occurring over firm bearing.

1. Paper-Faced Sheathing: Immediately after installation, protect from weather by application of water-resistive barrier.

E. Installation on Metal Framing: Use screws for attachment of gypsum board.

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 (10 meters) apart on walls and ceilings over 50 feet (16 meters) long.
2. Provide a control joint at both sides of the wall at every door frame. Locate at hinge side of door.
3. Provide a control joint at both sides of the wall at openings in the wall. Provide on one side of the opening for openings 48 inches wide or less. For openings over 48 inches, provide on both sides of the opening.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.07 JOINT TREATMENT

A. Glass Mat Faced Gypsum Board and Exterior Glass Mat Faced Sheathing: Use fiberglass joint tape, embed and finish with setting type joint compound.

B. Paper Faced Gypsum Board: Use paper joint tape, embed with drying type joint compound and finish with drying type joint compound.

C. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:

1. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish and other areas specifically indicated.
2. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
3. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
4. Level 1: 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 (0.8 mm).

E. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

3.08 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet (3 mm in 3 m) in any direction.

END OF SECTION

SECTION 09 3000 - TILING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tile for floor applications.
B. Tile for wall applications.
C. Tile for ceiling applications.
D. Non-ceramic trim.

1.02 RELATED REQUIREMENTS

A. Section 07 9200 - Joint Sealants: Sealing joints between tile work and adjacent construction and fixtures.

1.03 REFERENCE STANDARDS

A. ANSI A108/A118/A136 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium); 2024.
B. ANSI A108.19 - American National Standard Specifications for Interior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs by the Thin-Bed Method Bonded with Modified Dry-Set Cement Mortar or Improved Modified Dry-Set Cement Mortar; 2020.
C. ANSI A108.20 - American National Standard Specifications for Exterior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs; 2020.
D. ANSI A118.3 - American National Standard Specifications for Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive; 2021.
E. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation; 2019.
F. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation; 2023.
G. ANSI A118.15 - American National Standard Specifications for Improved Modified Dry-Set Cement Mortar; 2023.
H. ANSI A137.1 - American National Standard Specifications for Ceramic Tile; 2012.
I. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2025.
J. TCNA (HB-GP) - Handbook for Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs Installation; 2023.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by affected installers.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.
C. Samples: Provide two tiles, actual size, illustrating pattern and color.
D. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Tile: 10 sq ft (1 sq m) of each size, color, and surface finish combination.

1.06 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 7419 - Construction Waste Management and Disposal for packaging waste requirements.
B. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.07 FIELD CONDITIONS

A. Do not install solvent-based products in an unventilated environment.
B. Maintain ambient and substrate temperature above 50 degrees F (10 degrees C) and below 100 degrees F (38 degrees C) during installation and curing of setting materials.

1.08 WARRANTY

A. Tile and Stone Installation System Warranty: Manufacturer's standard system warranty protecting against break down or deterioration of the tile setting system under normal usage, and ensuring the products are free from manufacturer defects. Manufacturer shall pay for replacement of its own products and replacement of finishing materials, including labor, for defective portions of the project.
   1. Warranty Period: 25 years.

PART 2 PRODUCTS

2.01 TILE

A. Tile (T-#): ANSI A137.1 standard grade.
   1. Basis of Design: See drawings for product information.

2.02 TRIM AND ACCESSORIES

A. Non-Ceramic Trim (MT-#): Satin natural anodized extruded aluminum, style and dimensions to suit application, set with tile mortar or adhesive.
   1. Basis of Design: See drawings for product information.

2.03 SETTING MATERIALS

A. Improved Latex-Portland Cement Mortar Bond Coat: ANSI A118.15.
   1. Applications: Use this type of bond coat where indicated, and where no other type of bond coat is indicated.
      a. Typical Floors:
         1) LATICRETE 254 Platinum.
         2) TEC Specialty Full Flex.
      b. Typical Walls:
         1) LATICRETE Tri Lite.
         2) TEC Specialty Ultimate Large Tile.
   2. Products:
      a. H.B. Fuller Construction Products, Inc: www.tecspecialty.com/#sle.
      b. LATICRETE International, Inc: www.laticrete.com/#sle.
      c. Mapei Corporation: www.mapei.com/#sle.
      d. Substitutions: See Section 01 6000 - Product Requirements.

2.04 GROUTS

A. High Performance Polymer Modified Grout: ANSI A118.7 polymer modified cement grout.
   1. Applications: Use this type of grout for typical walls.
   2. Use sanded grout for joints 1/8 inch (3.2 mm) wide and larger; use unsanded grout for joints less than 1/8 inch (3.2 mm) wide.
   3. Color: As selected by Architect from manufacturer's full line.
   4. Basis of Design:
      a. H.B. Fuller Construction Products, Inc; TEC AccuColor Plus Grout: www.tecspecialty.com/#sle.
      b. LATICRETE International, Inc; LATICRETE PERMACOLOR Select Grout: www.laticrete.com/#sle.
      c. Mapei Corporation; Ultracolor Plus FA: www.mapei.com/#sle.
      d. Substitutions: See Section 01 6000 - Product Requirements.

B. Epoxy Grout: ANSI A118.3 chemical resistant and water-cleanable epoxy grout.
   1. Applications: Use where indicated on drawings.
   2. Color: As selected by Architect from manufacturer's full line.
   3. Basis of Design:
      a. Tile Floors:
         1) H.B. Fuller Construction Products, Inc; TEC AccuColor EFX Epoxy Special Effects Grout: www.tecspecialty.com.
         2) LATICRETE International, Inc; LATICRETE SpectraLOCK PRO Premium Grout.
         3) Mapei Corporation: www.mapei.com.

2.05 MAINTENANCE MATERIALS

A. Tile Sealant: Gunnable, silicone, siliconized acrylic, or urethane sealant; moisture and mildew resistant type.
   1. Applications: Between tile and plumbing fixtures.
   2. Color: As selected by Architect from manufacturer's full line.
   3. Products:
      a. LATICRETE International, Inc; LATICRETE LATASIL: www.laticrete.com/#sle.
      b. TEC Specialty; Silicone Caulk.
      c. Substitutions: See Section 01 6000 - Product Requirements.

2.06 ACCESSORY MATERIALS

A. Waterproofing Membrane: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.
   1. Application: Provide at walls, ceilings and floors in showers only.
   2. Fluid or Trowel Applied Type:
      a. Products:
         1) LATICRETE International, Inc; LATICRETE HYDRO BAN: www.laticrete.com/#sle.
         2) TEC Specialty; HydraFlex.
         3) Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify subfloor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive tile.

B. Verify wall surfaces are smooth and flat within tolerances specified for that type of work, are dust-free, and are ready to receive tile.

C. Verify that subfloor surfaces are dust free and free of substances that could impair bonding of setting materials to subfloor surfaces.

D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Vacuum clean surfaces and damp clean.

B. Seal substrate surface cracks with filler.

C. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

3.03 INSTALLATION - GENERAL

A. Install tile, thresholds, and stair treads and grout in accordance with applicable requirements of ANSI A108/A118/A136, manufacturer's instructions, and TCNA (HB) or TCNA (HB-GP) recommendations, as applicable.

B. Lay tile to pattern indicated on drawings. Do not interrupt tile pattern through openings.

C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.

D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.

E. Form internal angles square and external angles bullnosed.

F. Install non-ceramic trim in accordance with manufacturer's instructions.

G. Sound tile after setting. Replace hollow sounding units.

H. Keep control and expansion joints free of mortar, grout, and adhesive.

I. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

J. Grout tile joints unless otherwise indicated on drawings. Use standard grout unless otherwise indicated on drawings.

K. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

3.04 INSTALLATION - FLOORS - THIN-SET METHODS

A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F115, with epoxy grout. Provide waterproofing membrane under all tile.

1. Use uncoupling membrane under tile unless other underlayment is indicated on drawings.

3.05 INSTALLATION - WALL TILE

A. Over coated glass mat backer board on studs, install in accordance with TCNA (HB) Method W245.

B. Over gypsum wallboard on wood or metal studs, install in accordance with TCNA (HB) Method W243, thin-set with dry-set or latex-Portland cement bond coat.

3.06 CLEANING

A. Clean tile and grout surfaces.

3.07 PROTECTION

A. Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION

SECTION 09 5100 - ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

1.02 RELATED REQUIREMENTS

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

B. Divisions 21 through 28 for mechanical and electrical components in acoustical ceilings.

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; 2017.

B. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2022.

C. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2019 (Reapproved 2025).

D. 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.

E. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2023.

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 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on suspension system components and acoustical units.

C. Samples: Submit two samples 4 x 6 inch (100 x 150 mm) in size illustrating material and finish of acoustical units.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Extra Acoustical Units: Quantity equal to 5 percent of total installed.

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 MANUFACTURERS

A. Acoustic Tiles/Panels:
   1. Armstrong World Industries, Inc: www.armstrongceilings.com.
   2. Acoustical Surfaces, Inc.: www.acousticalsurfaces.com.
   3. CertainTeed Corporation: www.certainteed.com.
   4. USG Corporation: www.usg.com/ceilings.
   5. Substitutions: See Section 01 6000 - Product Requirements.

B. Suspension Systems:
   1. Armstrong World Industries, Inc: www.armstrongceilings.com.
   2. CertainTeed Corporation: www.certainteed.com.
   3. Rockfon, LLC: www.rockfon.com.
   4. USG Corporation: www.usg.com/ceilings.
   5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ACOUSTICAL UNITS

A. Acoustical Units - General: ASTM E1264, Class A.
   1. VOC Content: As specified in Section 01 6116.

B. Acoustical Panels (ACT-#): Painted mineral fiber, with the following characteristics:
   1. Basis of Design: As indicated on drawings.

C. ALTERNATE 6 - Acoustical Panels: Wood fiber bonded with inorganic binder, portland cement:
   1. Basis of Design: Envirocoustic Wood Wool Backfill Ceiling by Acoustical Surfaces, Inc.
      a. (WWAP-1):
         1) Panel Size: 24 inches x 24 inches.
         2) Edge Detail: Tegular.
         3) Mounting: Lay in/Ceiling Grid.
      b. (WWAP-2):
         1) Panel Size: 24 inches x 48 inches.
         2) Edge Detail: Bevel.
         3) Mounting: Direct Attachment.
   2. Panel Thickness: 2 inches.
   3. Finish: Clear.

2.03 SUSPENSION SYSTEM(S)

A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.
   1. Materials:
      a. Steel Grid: ASTM A653/A653M, G30 coating, unless otherwise indicated.

B. Exposed Suspension System: Hot-dipped galvanized steel grid and cap.
   1. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
   2. Profile: Tee; 9/16 inch (14 mm) face width.
   3. Finish: Baked enamel.
   4. Color: White.

2.04 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application and ceiling system flatness requirement specified.

B. Hanger Wire: 12 gauge, 0.08 inch (2 mm) galvanized steel wire.

C. Hold-Down Clips: Manufacturer's standard clips to suit application.

D. Perimeter Moldings: Same metal and finish as grid.

1. Size: As required for installation conditions.
2. Angle Molding: L-shaped, for mounting at same elevation as face of grid.

E. Touch-up Paint: Type and color to match acoustical and grid units.

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. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, ASTM C636/C636M, ASTM E580/E580M, ASTM C636/C636M, and ASTM E580/E580M and as supplemented in this section.

B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

C. Locate system on room axis according to reflected plan.

D. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.

1. Use longest practical lengths.
2. Miter corners.

E. Suspension System, Non-Seismic: 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.

F. 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.

G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

H. Support fixture loads using supplementary hangers located within 6 inches (152 mm) of each corner, or support components independently.

I. Do not eccentrically load system or induce rotation of runners.

3.03 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Fit border trim neatly against abutting surfaces.

D. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

E. Cutting Acoustical Units:

1. Make field cut edges of same profile as factory edges.

2. Double cut and field paint exposed reveal edges.

F. Where round obstructions occur, provide preformed closures to match perimeter molding.

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 5423 - LINEAR METAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Linear metal ceilings.

B. Suspended metal support system and perimeter trim.

1.02 RELATED REQUIREMENTS

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; 2017.

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.

1.04 SUBMITTALS

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

B. Product Data: Furnish for component profiles, materials, and perimeter and integral trim.

C. Shop Drawings: Indicate reflected ceiling plan.

1.05 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 7419 - Construction Waste Management and Disposal for packaging waste requirements.

B. Accept factory-finished products on site in manufacturer's unopened factory packaging only; reject opened packages.

C. Protect factory-finished products from damage to appearance by storing products in manufacturer's unopened factory packaging in dry storage area.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Linear Metal Ceilings:

1. Armstrong World Industries, Inc: www.armstrongceilings.com.
2. Rockfon, LLC: www.rockfon.com.
3. USG Corporation: www.usg.com/ceilings.
4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 LINEAR METAL CEILINGS

A. Linear Metal Ceiling System (MCT-#): Panels and baffles, suspension members, trim, and accessories as required to provide a complete system.

1. See drawings for products.

B. Performance Requirements:

1. Design to support imposed loads of indicated items without eccentric loading of supports.
2. Design for maximum deflection of 1/360 of span.
3. Systems Located Outside Building Envelope:

a. Accommodate wind and suction loads and wind uplift without damage in accordance with applicable code.

2.03 COMPONENTS

A. Linear Metal Panels:

B. Edge Molding and Splices: Same material, thickness, and finish as linear panels.

C. Accessories: Stabilizer bars as required for suspended grid system; sight-exposed surfaces same color and finish as sight-exposed surfaces of linear panels.

D. Suspension Members: Formed steel sections, with integral attachment points; galvanized finish; size and type to suit application and ceiling system flatness requirement specified.

E. Suspension Wire: Size and type as required for application and ceiling system flatness requirement specified.

F. Subgirt Members: Hot-dip galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating; formed to resist imposed loads and to provide attachment for linear ceiling and accessories.

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.

C. Verify that field measurements are as indicated.

3.02 INSTALLATION

A. Suspension Components:

1. Install after above-ceiling work is complete in accordance with ASTM C636/C636M, ASTM E580/E580M, ASTM C636/C636M, ASTM E580/E580M, ASTM C636/C636M, and ASTM E580/E580M.
2. Hang carrying members independent of walls, columns, ducts, light fixtures, pipe, and conduit; where carrying members are spliced, avoid visible displacement of face panels with adjacent panels.
3. Where ducts or other equipment prevent regular spacing of hangers, reinforce nearest adjacent hangers to span the required distance.

B. Linear Metal Ceiling:

1. Install linear panels and other system components in accordance with manufacturer's instructions.
2. Install edge moldings at junctions with other finishes and at vertical surfaces; use maximum piece lengths.
3. Exercise care when site cutting sight-exposed finished components to ensure surface finish is not defaced.

3.03 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.

C. Maximum Variation From Dimensioned Position: 1/4 inch (6 mm).

3.04 CLEANING

A. Replace damaged or abraded components.

END OF SECTION

SECTION 09 5426 - SUSPENDED WOOD CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wood grilles.

B. Metal suspension system.

1.02 RELATED REQUIREMENTS

A. Section 09 5100 - Acoustical Ceilings: Metal suspension systems.

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; 2017.

B. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.

C. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

D. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2022.

E. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2019 (Reapproved 2025).

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018.

G. 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.

H. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2023.

I. CISCA (WC) - Wood Ceilings Technical Guidelines; 2009.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Sequence work to ensure ceilings are not installed until building is enclosed, dust generating activities have terminated, and overhead work is completed.

1.05 SUBMITTALS

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

B. Shop Drawings: Indicate grid layout and related dimensioning, attachment of wood ceiling components to grid, accessory attachments, junctions with other ceiling finishes, and mechanical and electrical items installed in the ceiling.

C. Product Data: Provide data on wood ceiling components and suspension system components.

D. Samples: Submit two full size samples illustrating material and finish of wood ceiling components.

E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

F. Designer's qualification statement.

G. Manufacturer's qualification statement.

H. Installer's qualification statement.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements for additional provisions.

1.06 QUALITY ASSURANCE

A. Designer Qualifications for Seismic Design: Perform design under direct supervision of Professional Structural Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with at least three years documented experience.

C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

1.07 MOCK-UPS

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Locate where directed.

C. Mock-up may remain as part of the work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver wood ceiling components to project site in original, unopened packages.

B. Store in fully enclosed space, flat, level and off the floor.

1.09 FIELD CONDITIONS

A. Do not install suspended wood ceiling system until wet construction work is complete and permanent heat and air conditioning is installed and operating.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Suspended Wood Ceilings:

1. Armstrong World Industries, Inc; Woodworks: www.armstrongceilings.com/#sle.
2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 SUSPENDED WOOD CEILING SYSTEM

A. Performance Requirements:

1. Design for maximum deflection of 1/360 of span.

B. Wood-Based Materials:

1. Certified as sustainably harvested as specified in Section 01 6000.
2. Solid Wood: Clear, dry, sound, plain sawn, selected for compatible species, grain and color, no defects.
3. Composite Wood Panels: Containing no urea-formaldehyde resin binders.

C. Wood Grilles (WCS-#): Pre-assembled module of solid wood grilles with battens.

1. Basis of Design: As indicated on drawings.
2. Acoustical Backer: Fiberglass, 1 inch (25 mm) thick.

D. Metal Suspension System:

1. General: Comply with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.
   a. Materials:
      1) Aluminum Grid: Aluminum sheet, ASTM B209/B209M.
2. Concealed Ceiling Suspension System: Aluminum grid.

a. Description: Engineered grid, with slotted faces in main tees, cross tees, hangers, trim molding, load resisting struts, hinge assemblies, and other suspension components required to support ceiling and other ceiling supported construction. Panels installed from below by inserting torsion springs into slots in faces of main tees of ceiling grid.
b. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
c. Profile: Flat.
d. Finish: Powder coat.
e. Color: Black.
f. Products:
1) Certainteed Architectural: www.certainteed.com/ceilings-and-walls/#sle.
2) USG Corporation: www.usg.com/ceilings/#sle.
3) Substitutions: See Section 01 6000 - Product Requirements.

3. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement.

E. Accessories: Manufacturer's standard accessories for installation method indicated, seismic requirements and above-ceiling accessibility.

2.03 FABRICATION

A. Shop fabricate wood ceiling components to the greatest extent possible.
B. Fabricate components to allow access to ceiling plenum as required.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.
B. Do not install ceiling until after interior wet work is dry.

3.02 PREPARATION

A. Coordinate the location of hangers with other work.
B. Provide hanger clips during steel deck erection. Provide additional hangers and inserts as required.
C. Layout wood ceiling components in pattern according to reflected ceiling plan and as shown on shop drawings.
D. Acclimate wood ceiling materials by removing from packaging in installation area a minimum of 48 hours prior to installation.

3.03 INSTALLATION

A. General: Install suspended wood ceiling system in accordance with CISCA (WC).
B. Suspension System:
1. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.
2. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
3. 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.
4. 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.

5. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
6. Support fixture loads using supplementary hangers located within 6 inches (152 mm) of each corner, or support components independently.
7. Do not eccentrically load system or induce rotation of runners.

C. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.

D. Wood Ceiling:
1. Install wood ceilings in accordance with manufacturer's instructions.
2. Fit wood components in place, free from damaged edges or other defects detrimental to appearance and function.
3. Install components in uniform plane, and free from twist, warp, and dents.
4. Cut to fit irregular grid and perimeter edge trim.
5. Make field cut edges of same profile as factory edges, seal and finish according to manufacturer.
6. Install acoustical backer above wood ceiling components; fit tight between grid members.

3.04 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet (3 mm in 3 m).

3.05 CLEANING

A. Clean and touch up minor finish damage. Remove and replace components that cannot be successfully cleaned and repaired.

END OF SECTION

SECTION 09 6500 - RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

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

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
B. Section 03 3000 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied resilient flooring.

1.03 REFERENCE STANDARDS

A. ASTM F1861 - Standard Specification for Resilient Wall Base; 2021.
B. ASTM F2034 - Standard Specification for Sheet Linoleum Floor Covering; 2018 (Reapproved 2025).

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
C. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.
D. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.
E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
    1. See Section 01 6000 - Product Requirements, for additional provisions.
    2. Extra Flooring Material: 100 square feet (9.29 square meters) of each type and color.
    3. Extra Wall Base: 20 linear feet (6.1 linear meters) of each type and color.

1.05 FIELD CONDITIONS

A. 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).

1.06 WARRANTY

A. Manufacturer's standard limited 5 year commercial warranty.

PART 2 PRODUCTS

2.01 SHEET FLOORING

A. Linoleum Sheet Flooring (LSF-#): Homogeneous wear layer bonded to backing, with color and pattern through wear layer thickness:
    1. Minimum Requirements: Comply with ASTM F2034, Type corresponding to type specified.
    2. Backing: Jute fabric.
    3. Thickness: 0.100 inch (2.5 mm), minimum, excluding backing.
    4. Pattern & Color: As indicated on drawings.

2.02 RESILIENT BASE

A. Resilient Base (RB-#): ASTM F1861, Type TS rubber, vulcanized thermoset; style as scheduled.
   1. Basis of Design: See drawings for product information.
   2. Height: 4 inches (100 mm).
   3. Thickness: 0.125 inch (3.2 mm).
   4. Finish: Satin.
   5. Length: Roll.

2.03 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.
B. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.
C. Filler for Coved Base: Plastic.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.
B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.
C. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
   1. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.
D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Remove subfloor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface.
B. Prohibit traffic until filler is fully cured.
C. Clean substrate.
D. Apply primer as required to prevent "bleed-through" or interference with adhesion by substances that cannot be removed.

3.03 INSTALLATION - GENERAL

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

3.04 INSTALLATION - SHEET FLOORING

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

3.05 INSTALLATION - 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 written instructions.

3.07 PROTECTION

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

END OF SECTION

SECTION 09 6566 - RESILIENT ATHLETIC FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Rubber sheet flooring, adhesively installed.

1.02 SUBMITTALS

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

B. Product Data: Manufacturer's printed data sheets for products specified.

C. Shop Drawings: Fabrication and installation details, and layout, colors, and widths of game lines and equipment locations.

D. Verification Samples: Actual flooring material specified, not less than 12 inch (305 mm) square, mounted on solid backing.

1.03 QUALITY ASSURANCE

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

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site in unopened containers clearly labeled with manufacturer's name and identification of contents.

B. Store materials in dry and clean location until needed for installation. During installation, handle in a manner that will prevent marring and soiling of finished surfaces.

1.05 FIELD CONDITIONS

A. Maintain temperature in spaces to receive adhesively installed resilient flooring within range of 70 to 95 degrees F (21 to 35 degrees C) for not less than 48 hours before the beginning of installation and for not less than 48 hours after installation has been completed. Subsequently, do not allow temperature in installed spaces to drop below 50 degrees F (10 degrees C) or to go above 100 degrees F (38 degrees C).

PART 2 PRODUCTS

2.01 PREFORMED ATHLETIC FLOORING

A. Rubber Sheet Flooring (RAF-#): Rubber athletic flooring, calendered and vulcanized.

1. Top and bottom layers shall have different shore hardness and elasticity.
2. Thickness: 10 mm.
3. Shore A Hardness: 53/37 per ASTM D2240, minimum.
4. Finish Texture: Embossed.
5. Roll width: 3 to 6 feet.
6. Roll length: 40 feet minimum.
7. Colors:
8. Products:
    a. Mondo USA, Inc; Sportflex: www.mondoindoorsportusa.com.
    b. Connor Sports; TruSport: www.connorsports.com.
    c. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ACCESSORIES

A. Leveling Compound: Latex-modified cement formulation as recommended by flooring manufacturer for substrate conditions.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates for conditions detrimental to installation of athletic flooring. Proceed with installation only after unsatisfactory conditions have been corrected.

B. 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 athletic flooring to substrate.

C. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).

1. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

3.02 PREPARATION

A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

B. Concrete: Use leveling compound as necessary to achieve substrate flatness of plus or minus 1/8 inch within 10 ft radius (1/1000).

C. Remove coatings that are incompatible with flooring adhesives, using methods recommended by flooring manufacturer.

D. Broom clean areas to receive athletic flooring immediately before beginning installation.

3.03 INSTALLATION

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install in accordance with manufacturer's written instructions and approved shop drawings.

3.04 CLEANING

A. Clean flooring using methods recommended by manufacturer.

3.05 PROTECTION

A. Protect finished athletic flooring from construction traffic to ensure that it is without damage upon Date of Substantial Completion.

END OF SECTION

SECTION 09 6623 - RESINOUS MATRIX TERRAZZO FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Epoxy matrix terrazzo with ground and polished finish.

B. Precast epoxy terrazzo stair units.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete subfloor with steel trowel finish.

B. Section 09 9600 - High-Performance Coatings: Slip resistant coating applied to terrazzo flooring.

1.03 REFERENCE STANDARDS

A. NTMA (GRAD) - Aggregate Gradation Standards; Current Edition.

B. NTMA (EPOXY) - Epoxy Terrazzo Specifications; Current Edition.

1.04 SUBMITTALS

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

B. Product Data: Provide data for divider strips, control joint strips, expansion joints, and sealer; include printed copy of current NTMA recommendations for type of terrazzo specified.

C. Shop Drawings: Indicate divider strip and control and expansion joint layout, and details of adjacent components. For precast units, detail profile and anchorage requirements.

D. Samples: Submit two samples, 12 inch (304 mm) by 12 inch (305 mm) in size illustrating color, chip size and variation, chip gradation, matrix color, and typical divider strip.

E. Cleaning and Maintenance Data: Include procedures for stain removal, stripping, and sealing.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with NTMA recommendations as posted at their web site at www.ntma.com.

B. Installer Qualifications: Company specializing in performing the type of work specified in this section.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store terrazzo materials in a dry, secure area.

B. Maintain minimum temperature of 60 degrees F (16 degrees C).

C. Keep products away from fire or open flame.

1.07 FIELD CONDITIONS

A. Do not install terrazzo when temperature is below 50 degrees F (10 degrees C) or above 90 degrees F (32 degrees C).

B. Maintain temperature within specified range 24 hours before, during, and 72 hours after installation of flooring.

C. Provide ambient lighting level of 50 ft candles (540 lx), measured at floor surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Resinous Matrix Terrazzo Flooring:

1. Key Resin Company: www.keyresin.com.

2. Sherwin-Williams High Performance Flooring; ____: www.sherwin-williams.com/resin-flooring/#sle.
3. Terrazzo & Marble Supply Companies: www.tmsupply.com.
4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 EPOXY MATRIX TERRAZZO APPLICATIONS

A. Stairs - Treads and Landings:
1. Basis of Design: Wausau SS30 Cement Self Supporting Flat Tread with Stainless Steel Bar: www.wausautile.com.
2. Color: To be selected from manufacturer's full line.

2.03 MATERIALS

A. Epoxy Matrix Terrazzo: Aggregate and matrix mix applied to substrate, troweled flat, and ground smooth.
1. Mix Proportions: As required to achieve appearance specified.
B. Matrix: Two component resin and epoxy hardener with mineral filler and color pigment, non-volatile, thermo-setting.
C. Aggregate: Type as indicated; sized in accordance with NTMA aggregate gradation standards; color(s) as indicated, uniform in color.
D. Finishing Grout: Epoxy, color to match terrazzo matrix.

2.04 ACCESSORIES

A. Divider Strips: 1/8 inch (3 mm) thick zinc exposed top strip, zinc coated steel concealed bottom strip, with anchoring features.
B. Control Joint Strips: 1/8 inch (3 mm) nominal width zinc exposed top strips, zinc coated steel concealed bottom strips, 1/8 inch (3 mm) wide neoprene filler strip between vertical strips, with anchoring features.
C. Divider and Control Joint Strip Height: To suit thickness of terrazzo topping, with allowance for grinding.
D. Crack Suppression Membrane: Provide manufacturer's recommended crack suppression system under all terrazzo.
E. Base Cap, Base Divider Strip, and Separator Strip: Match divider strips.
F. Non-Slip Inserts: Provide channel-shaped inserts filled with a mixture of resin and fine, abrasive aggregate.
G. Sealer: Colorless, non-yellowing, penetrating liquid type to completely seal matrix surface; not detrimental to terrazzo components.
H. Wood Subfloor Filler: Latex type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive terrazzo.
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 terrazzo.
C. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of materials to subfloor surfaces.

D. Cementitious Subfloor Surfaces: Verify that substrates are ready for terrazzo flooring installation by testing for moisture and alkalinity (pH).
   1. Obtain instructions if test results are not within limits recommended by terrazzo flooring manufacturer.

E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Clean substrate of foreign matter.

B. Prepare concrete subfloor by mechanically abrading surface in accordance with manufacturer's instructions.

C. Apply primer in accordance with manufacturer's instructions.

3.03 INSTALLATION

A. Install control joint strips straight and flat to locations indicated.

B. Install divider strips according to pattern approved on shop drawings.

C. Install recessed floor mat frames.

D. Install base and border divider and control joint strips to match floor pattern.

E. Install terminating cap strip at top of base; attach securely to wall substrate.

F. Place terrazzo mix over substrate to thickness indicated.

3.04 FINISHING

A. Finish terrazzo to NTMA requirements.

B. Produce terrazzo finish surface to match approved mock-up, with 70 percent chip exposed.

C. Grind terrazzo surfaces with power disc machine; sequence with coarse to fine grit abrasive, using a wet method or using a dry grinder with vacuum to control dust.

D. Apply grout to fill voids exposed from grinding.

E. Remove grout coat by grinding, using a fine grit abrasive.

F. Hand grind vertical and curved surfaces similarly.

3.05 TOLERANCES

A. Maximum Variation from Flat Surface: 1/4 inch in 10 feet (6 mm in one m).

B. Maximum Variation from Level (Except Surfaces Sloping to Drain): 1/8 inch (3 mm).

3.06 CLEANING

A. Scrub and clean terrazzo surfaces with neutral pH cleaner in accordance with manufacturer's instructions. Let dry.

B. Immediately after terrazzo has dried, apply sealer in accordance with manufacturer's instructions.

C. Polish surfaces in accordance with manufacturer's instructions.

3.07 PROTECTION

A. Protect finished terrazzo from damage due to subsequent construction until Date of Substantial Completion.

END OF SECTION

SECTION 09 6813 - TILE CARPETING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Carpet tile, fully adhered.

1.02 RELATED REQUIREMENTS

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

B. Section 03 3000 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied flooring.

1.03 REFERENCE STANDARDS

A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials; 2016 (Reapproved 2021).

B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.

C. CRI 104 - Standard for Installation of Commercial Carpet; 2015.

1.04 SUBMITTALS

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

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

C. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.

D. Manufacturer's Installation Instructions: Indicate special procedures.

E. Operation and Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet tile with minimum three years documented experience.

B. Installer Qualifications: Company specializing in installing carpet tile with minimum three years documented experience.

1.06 FIELD CONDITIONS

A. Store materials in area of installation for minimum period of 24 hours prior to installation.

PART 2 PRODUCTS

2.01 MATERIALS

A. Tile Carpeting (CPT-#): Each type manufactured in one color dye lot.

1. See drawings for schedule of carpet tiles.

2.02 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by flooring material manufacturer.

B. Edge Strips: Rubber, color as selected by Architect.

C. Adhesives:

1. Compatible with materials being adhered; maximum VOC content of 50 g/L; CRI (GLP) certified; in lieu of labeled product, independent test report showing compliance is acceptable.

D. Carpet Tile Adhesive: Recommended by carpet tile manufacturer; releasable type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.

B. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to subfloor surfaces.

C. Cementitious Subfloor Surfaces: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).

1. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.

D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

B. Remove subfloor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler.

C. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.

D. Vacuum clean substrate.

3.03 INSTALLATION

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install carpet tile in accordance with manufacturer's instructions.

C. Blend carpet from different cartons to ensure minimal variation in color match.

D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.

E. Trim carpet tile neatly at walls and around interruptions.

F. Complete installation of edge strips, concealing exposed edges.

3.04 CLEANING

A. Remove excess adhesive without damage, from floor, base, and wall surfaces.

B. Clean and vacuum carpet surfaces.

END OF SECTION

SECTION 09 8430 - SOUND-ABSORBING WALL AND CEILING UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sound-absorbing panels.

1.02 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018.

1.03 SUBMITTALS

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

B. Product Data: Manufacturer's printed data sheets for products specified.

C. Shop Drawings: Fabrication and installation details, panel layout, fabric orientation, and wood grain orientation.

D. Verification Samples: Fabricated samples of each type of panel specified; 12 by 12 inch (305 by 305 mm), showing construction, edge details, and fabric covering.

1.04 QUALITY ASSURANCE

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

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect acoustical units from moisture during shipment, storage, and handling. Deliver in factory-wrapped bundles; do not open bundles until units are needed for installation.

B. Store units flat, in dry, well-ventilated space; do not stand on end.

C. Protect edges from damage.

PART 2 PRODUCTS

2.01 FABRIC-COVERED SOUND-ABSORBING UNITS

A. Manufacturers:

1. Acoustical Surfaces, Inc.: www.acousticalsurfa
2. Conwed Designscape/Wall Technology: www.conweddesignscape.com.
3. Egan Visual Corporation: www.egan.com.
4. Essi Acoustical Products Company: www.essiacoustical.com.
5. Rockfon; Baffles: www.rockfon.com.
6. TECHLITE: www.techlite.com.
7. Substitutions: See Section 01 6000 - Product Requirements.

B. General:

1. Prefinished, factory assembled fabric-covered panels.
2. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.

C. Fabric-Covered Acoustical Panels for Walls (SAWP-#):

1. Basis of Design: As indicated on drawings.
2. Panel Core: Manufacturer's standard rigid or semi-rigid fiberglass core.
3. Panel Thickness: 1 inch (24 mm).

4. Edges: Perimeter edges reinforced by a formulated resin hardener.
5. Corners: Square.
6. Fabric: Woven polyester.
7. Color: As selected by Architect from manufacturer's full range.
8. Mounting Method: Back-mounted with mechanical fasteners.

D. ALTERNATE 6 - Wood Wool Acoustic Wall Panels (WWAP-3):
1. Basis of Design: Envirocoustic Wood Wool Wall Panels by Acoustical Surfaces, Inc.
2. Panel Core: Wood fiber bonded with inorganic binder, Portland cement.
3. Panel Thickness: 2 inches.
4. Panel Size: 24 inches x 48 inches.
5. Edges: Bevel.
6. Corners: Square.
7. Finish: Clear.
8. Mounting Method: Direct Attachment.

2.02 FABRICATION

A. Fabric Wrapped, General: Fabricate panels to sizes and configurations as indicated, with fabric facing installed without sagging, wrinkles, blisters, or visible seams.

B. Tolerances: Fabricate to finished tolerance of plus or minus 1/16 inch (1.6 mm) for thickness, overall length and width, and squareness from corner to corner.

2.03 ACCESSORIES

A. Back-Mounting Accessories: Manufacturer's standard accessories for concealed support, designed to allow panel removal, and as follows:
1. Two-part clip and base-support bracket system; brackets designed to support full weight of panels and clips designed for lateral support, with one part mechanically attached to back of panel and the other attached to substrate.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates for conditions detrimental to installation of acoustical units. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install acoustical units in locations as indicated, following manufacturer's installation instructions.

B. Install mounting accessories and supports in accordance with shop drawings.

C. Align panels accurately, with edges plumb and top edges level. Scribe to fit accurately at adjoining work and penetrations.

D. Install acoustical units to construction tolerances of plus or minus 1/16 inch (1.6 mm) for the following:
1. Plumb and level.
2. Flatness.
3. Width of joints.

3.03 CLEANING

A. Clean sound-absorptive panels upon completion of installation from dust and other foreign materials, following manufacturer's instructions.

3.04 PROTECTION

A. Provide protection of installed acoustical panels until Date of Substantial Completion.

B. Replace panels that cannot be cleaned and repaired to satisfaction of the Architect.

END OF SECTION

SECTION 09 9113 - EXTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished unless noted otherwise including, but not limited to, the following.

1. Exposed surfaces of steel lintels and ledge angles.
2. Mechanical and Electrical:
    a. Exterior mechanical and electrical: Paint all mechanical and electrical pipes, conduits, etc that penetrate exterior building walls, except as indicated below in paragraph D.

D. Do Not Paint or Finish the Following Items:

1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
2. Items indicated to receive other finishes.
3. Items indicated to remain unfinished.
4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
5. Stainless steel, anodized aluminum, bronze, terne-coated stainless steel, zinc, and lead.
6. Floors, unless specifically indicated.
7. Glass.
8. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

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

B. Section 09 9123 - Interior Painting.

C. Divisions 21 through 26: Identification for mechanical and electrical systems.

1.03 REFERENCE STANDARDS

A. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2020 (Reapproved 2025).

B. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.

C. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).

D. SSPC-SP 2 - Hand Tool Cleaning; 2024.

E. SSPC-SP 6/NACE No.3 - Commercial Blast Cleaning; 2006.

F. SSPC-SP 13/NACE No.6 - Surface Preparation of Concrete; 2018.

1.04 SUBMITTALS

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

B. Product Data: Provide complete list of products to be used, with the following information for each:

1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
2. MPI product number (e.g. MPI #47).
3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.

C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches (216 by 279 mm) in size, illustrating range of colors available for each finishing product specified.
   1. Where sheen is specified, submit samples in only that sheen.
   2. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens not required.
   3. Paint color submittals will not be considered until color submittals for major materials not to be painted, such as masonry, have been approved.
D. Certification: By manufacturer that paints and finishes comply with VOC limits specified.
E. Manufacturer's Instructions: Indicate special surface preparation procedures.
F. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.
G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Paint and Finish Materials: 1 gallon (4 L) of each color, sheen, type, sheen, surface texture, sheen, and sheen; from the same product run, store where directed.
   3. Label each container with color in addition to the manufacturer's label.

1.05 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 five years experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.07 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the paint product manufacturer's temperature ranges.
B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
D. Minimum Application Temperatures for Latex Paints: 50 degrees F (10 degrees C) for exterior; unless required otherwise by manufacturer's instructions.
E. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.

B. Paints:

1. Benjamin Moore & Co: www.benjaminmoore.com.
2. Diamond Vogel Paints: www.diamondvogel.com.
3. PPG Paints: www.ppgpaints.com.
4. Pratt & Lambert Paints: www.prattandlambert.com.
5. Sherwin-Williams Company: www.sherwin-williams.com.

C. Primer Sealers: Same manufacturer as top coats.

D. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready-mixed, unless required to be a field-catalyzed paint.

1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
3. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
4. Supply each paint material in quantity required to complete entire project's work from a single production run.
5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is described explicitly in manufacturer's product instructions.

B. Volatile Organic Compound (VOC) Content: Comply with Section 01 6116.

C. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

D. Colors: To be selected from manufacturer's full range of available colors.

1. Selection to be made by Architect after award of contract.
2. Allow for minimum of six colors for each system, unless otherwise indicated, without additional cost to Owner.
3. Extend colors to surface edges; colors may change at any edge as directed by Architect.

2.03 PAINT SYSTEMS - EXTERIOR

A. Paint E-OP - Exterior Surfaces to be Painted, Unless Otherwise Indicated: Including concrete, concrete masonry units, primed wood, and primed metal.

1. Two top coats and one coat primer.
2. Top Coat(s): Exterior Latex; MPI #10, 11, 15, 119, or 214.
3. Primer: As recommended by top coat manufacturer for specific substrate.
4. Masonry: One coat of block filler as recommended by top coat manufacturer for specific substrate.

2.04 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been properly prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

E. Test shop-applied primer for compatibility with subsequent cover materials.

F. 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. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
2. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.

D. Seal surfaces that might cause bleed through or staining of topcoat.

E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

F. Concrete:

1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
2. Prepare surface as recommended by top coat manufacturer and in accordance with SSPC-SP 13/NACE No.6.

G. Masonry:

1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
2. Prepare surface as recommended by top coat manufacturer.

H. Galvanized Surfaces:

1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
2. Prepare surface according to SSPC-SP 2.

I. Ferrous Metal:

1. Solvent clean according to SSPC-SP 1.
2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning in accordance with SSPC-SP 6/NACE No.3. Protect from corrosion until coated.

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

K. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Exterior Wood to Receive Opaque Finish: If final painting must be delayed more than 2 weeks after installation of woodwork, apply primer within 2 weeks and final coating within 4 weeks.

C. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

E. Apply each coat to uniform appearance.

F. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply additional coats until complete hide is achieved.

G. Sand wood and metal surfaces lightly between coats to achieve required finish.

H. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

I. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

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

3.05 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 09 9123 - INTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.

1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
2. Elevator pit ladders.
3. Prime surfaces to receive wall coverings.
4. Mechanical and Electrical:
    a. In finished areas, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
    b. In finished areas, paint shop-primed items.
    c. Paint interior surfaces of air ducts and convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.
    d. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.

D. Do Not Paint or Finish the Following Items:

1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
2. Items indicated to receive other finishes.
3. Items indicated to remain unfinished.
4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
5. Stainless steel, anodized aluminum, bronze, terne-coated stainless steel, and lead items.
6. Floors, unless specifically indicated.
7. Ceramic and other tiles.
8. Glass.
9. Concrete masonry units in utility, mechanical, and electrical spaces.
10. Acoustical materials, unless specifically indicated.
11. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

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

B. Section 09 9113 - Exterior Painting.

C. Divisions 21 through 26: Identification for mechanical and electrical systems.

1.03 REFERENCE STANDARDS

A. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2020 (Reapproved 2025).

B. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.

C. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).
D. SSPC-SP 6/NACE No.3 - Commercial Blast Cleaning; 2006.
E. SSPC-SP 13/NACE No.6 - Surface Preparation of Concrete; 2018.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g., "alkyd enamel").
   2. MPI product number (e.g., MPI #47).
   3. Cross-reference to specified paint system products to be used in project; include description of each system.
C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches (216 by 279 mm) in size, illustrating range of colors available for each finishing product specified.
   1. Where sheen is specified, submit samples in only that sheen.
   2. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens not required.
   3. Paint color submittals will not be considered until color submittals for major materials not to be painted, such as masonry, have been approved.
D. Certification: By manufacturer that paints and finishes comply with VOC limits specified.
E. Manufacturer's Instructions: Indicate special surface preparation procedures.
F. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.
G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Paint and Finish Materials: 1 gal (4 L) of each color; from the same product run, store where directed.
   3. Label each container with color in addition to the manufacturer's label.

1.05 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 five years experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.07 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply materials when relative humidity exceeds 85 percent, at temperatures less than 5 degrees F (3 degrees C) above the dew point, or to damp or wet surfaces.

D. Minimum Application Temperatures for Paints: 50 degrees F (10 degrees C) for interiors unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 fc (860 lux) measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.

B. Primer Sealers: Same manufacturer as top coats.

C. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready-mixed, unless intended to be a field-catalyzed paint.

1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
3. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
4. Supply each paint material in quantity required to complete entire project's work from a single production run.
5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Volatile Organic Compound (VOC) Content: See Section 01 6116.

C. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

D. Colors (PT-#): As indicated on drawings.

1. Allow for minimum of six colors for each system, unless otherwise indicated, without additional cost to Owner.
2. Extend colors to surface edges; colors may change at any edge as directed by Architect.

2.03 PAINT SYSTEMS - INTERIOR

A. Paint I-OP - Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board, concrete, concrete masonry units, wood, uncoated steel, shop primed steel, and galvanized steel.

1. Two top coats and one coat primer.
2. Top Coat(s): Interior Latex.
   a. Basis of Design Products:

1) Benjamin Moore Ultra Spec 500.
2) Sherwin-Williams ProMar 200 Zero VOC.
3) PPG Paints.

3. Primer: As recommended by top coat manufacturer for specific substrate.

B. Paint I-OP-MD-DT - Medium Duty Door/Trim: For surfaces subject to frequent contact by occupants, including metals and wood:

1. Medium duty applications include doors, door frames, railings, handrails, guardrails, and balustrades, unless noted otherwise.
2. Two top coats and one coat primer.
3. Top Coat(s): High Performance Architectural Interior.
   a. Basis of Design Products:
      1) Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy, Eg-Shel. (MPI #139)
      2) Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy, Semi-Gloss. (MPI #141)
      3) PPG Paints Pitt-Tech Plus EP DTM Acrylic, Satin.
4. Primer: As recommended by top coat manufacturer for specific substrate.

C. Paint I-OP-DF - Dry Fall: Metals; exposed structure and overhead-mounted services in utilitarian spaces, including shop primed steel deck, structural steel, metal fabrications, galvanized ducts, galvanized conduit, and galvanized piping.

1. Shop primer by others.
2. One top coat.
3. Top Coat: Latex Dry Fall; MPI #118, 155, or 226.
   a. Basis of Design Products:
      1) Sherwin-Williams Waterborne Acrylic Dryfall, Eg-Shel. (MPI #155, 226)
4. Primer: As recommended by top coat manufacturer for specific substrate.

2.04 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been adequately prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

E. Test shop-applied primer for compatibility with subsequent cover materials.

F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is below the following maximums:

1. Gypsum Wallboard: 12 percent.
2. Masonry, Concrete, and Concrete Masonry Units: 12 percent.

3. Interior Wood: 15 percent, measured in accordance with ASTM D4442.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

D. Seal surfaces that might cause bleed through or staining of topcoat.

E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

F. Concrete:

1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
2. Prepare surface as recommended by top coat manufacturer and in accordance with SSPC-SP 13/NACE No.6.

G. Masonry:

1. Remove efflorescence and chalk. Do not coat surfaces if moisture content, alkalinity of surfaces, or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
2. Prepare surface as recommended by top coat manufacturer.

H. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.

I. Galvanized Surfaces:

1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.

J. Ferrous Metal:

1. Solvent clean according to SSPC-SP 1.
2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning in accordance with SSPC-SP 6/NACE No.3. Protect from corrosion until coated.

K. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

L. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

D. Apply each coat to uniform appearance in thicknesses specified by manufacturer.

E. Sand wood and metal surfaces lightly between coats to achieve required finish.

F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

G. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

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

3.05 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 09 9600 - HIGH-PERFORMANCE COATINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. High performance coatings.

B. Surface preparation.

1.02 RELATED REQUIREMENTS

A. Section 09 9123 - Interior Painting: Requirements for mechanical and electrical equipment surfaces.

1.03 REFERENCE STANDARDS

A. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating; 2023.

B. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association; Current Edition.

C. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.

D. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).

E. SSPC-SP 2 - Hand Tool Cleaning; 2024.

F. SSPC-SP 6/NACE No.3 - Commercial Blast Cleaning; 2006.

G. SSPC-SP 13/NACE No.6 - Surface Preparation of Concrete; 2018.

1.04 SUBMITTALS

A. See Section 01 3000 - 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 coating system(s) product is to be used in; include description of each system.
4. Manufacturer's installation instructions.

C. Samples: Submit two samples 8 by 8 inch (203 by 203 mm) in size illustrating colors available for selection.

D. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

E. Maintenance Data: Include cleaning procedures and repair and patching techniques.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. Extra Coating Materials: 1 gallon (4 liters) of each type and color.
2. Label each container with manufacturer's name, product number, color number, and room names and numbers where used.

1.05 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.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of coating, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Coating Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.07 FIELD CONDITIONS

A. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

B. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the coating product manufacturer.

C. Do not install materials when temperature is below 55 degrees F (13 degrees C) or above 90 degrees F (32 degrees C).

D. Maintain this temperature range, 24 hours before, during, and 72 hours after installation of coating.

E. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

F. Restrict traffic from area where coating is being applied or is curing.

1.08 WARRANTY

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

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Warranty: Include coverage for bond to substrate.

PART 2 PRODUCTS

2.01 MANUFACTURERS

2.02 TOP COAT MATERIALS

A. Coatings - General: Provide complete multi-coat systems formulated and recommended by manufacturer for the applications indicated, in the thicknesses indicated; number of coats specified does not include primer or filler coat.

B. Epoxy Coating (HPC-1):

1. Number of coats: Two.
2. Product Characteristics:
    a. Percentage of solids by volume, 70, minimum.
    b. Dry film thickness, per coat, 5 mil, minimum.
    c. Comply with the performance requirements specified above for moderate exposure.
3. Top Coat(s): Polyamide Epoxy; MPI #77, #177.
    a. Color: As selected by Architect.
    b. Sheen: Gloss.
    c. Basis of Design Products:
        1) Sherwin-Williams; Macropoxy 646 Fast Cure Epoxy: www.protective.sherwin-williams.com. (MPI #177)
4. Primer: As recommended by coating manufacturer for specific substrate.

C. Masonry Filler: Vehicle and resin compatible with topcoats, formulated for applied thickness of 10-20 mils (0.25-0.50 mm); Basis of Design: Kem Cati-Coat HS Epoxy Filler/Sealer manufactured by Sherwin Williams.

2.03 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of coated surfaces.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Do not begin application of coatings until substrates have been properly prepared.

C. Verify that substrate surfaces are ready to receive work as instructed by the coating manufacturer. Obtain and follow manufacturer's instructions for examination and testing of substrates.

D. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

E. Masonry: Verify masonry joints are struck flush.

3.02 PREPARATION

A. Clean surfaces of loose foreign matter.

B. Remove substances that would bleed through finished coatings. If unremovable, seal surface with shellac.

C. Remove finish hardware, fixture covers, and accessories and store.

D. Concrete:

1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
2. Clean concrete according to ASTM D4258. Allow to dry.
3. Prepare surface as recommended by coating manufacturer and in accordance with SSPC-SP 13/NACE No.6.

E. Galvanized Surfaces:

1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
2. Prepare surface according to SSPC-SP 2.

F. Ferrous Metal:

1. Solvent clean according to SSPC-SP 1.
2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning in accordance with SSPC-SP 6/NACE No.3, and protect from corrosion until coated.

3.03 PRIMING

A. Apply primer to all surfaces, unless specifically not required by coating manufacturer. Apply in accordance with coating manufacturer's instructions.

B. Concrete Masonry: Apply masonry filler to thickness required to fill holes and produce smooth surface; minimum thickness of 10 mils (0.250 mm).

3.04 COATING APPLICATION

A. Apply coatings in accordance with manufacturer's written instructions, to thicknesses specified and recommendations in MPI - Architectural Painting and Specification Manual.

B. Apply in uniform thickness coats, without runs, drips, pinholes, brush marks, or variations in color, texture, or finish. Finish edges, crevices, corners, and other changes in dimension with full coating thickness.

3.05 CLEANING

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

B. Clean surfaces immediately of overspray, splatter, and excess material.

C. After coating has cured, clean and replace finish hardware, fixtures, and fittings previously removed.

3.06 PROTECTION

A. Protect finished work from damage.

END OF SECTION

SECTION 10 1100 - VISUAL DISPLAY UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Porcelain enamel steel markerboards.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Blocking and supports.

1.03 REFERENCE STANDARDS

A. ANSI A208.1 - American National Standard for Particleboard; 2022.

1.04 SUBMITTALS

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

B. Product Data: Provide manufacturer's data on chalkboard, porcelain enamel steel markerboard, glass markerboard, tackboard, tackboard surface covering, trim, and accessories.

C. Shop Drawings: Indicate wall elevations, dimensions, joint locations , special anchor details.

D. Samples: Submit two samples 2 by 2 inch (50 by 50 mm) in size illustrating materials and finish, color and texture of markerboard, tackboard, and trim.

E. Manufacturer's printed installation instructions.

F. Maintenance Data: Include data on regular cleaning, stain removal .

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.06 WARRANTY

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

B. Provide five year warranty for markerboard to include warranty against discoloration due to cleaning, crazing or cracking, and staining.

PART 2 PRODUCTS

2.01 VISUAL DISPLAY UNITS

A. Markerboards (MRKBD-1): Porcelain enamel on steel, laminated to core.

1. Basis of Design: As indicated on drawings.
2. Steel Face Sheet Thickness: 24 gauge, 0.0239 inch (0.61 mm).
3. Core: Particleboard, manufacturer's standard thickness, laminated to face sheet.
4. Backing: Magnetic.
5. Size: As indicated on drawings.

2.02 MATERIALS

A. Particleboard: ANSI A208.1; wood chips, set with waterproof resin binder, sanded faces.

B. Steel Sheet Backing: 28 gauge, 0.0149 inch (0.38 mm), galvanized.

C. Adhesives: Type used by manufacturer.

2.03 ACCESSORIES

A. Mounting Brackets: Concealed; Z-Clip.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that internal wall blocking is ready to receive work and positioning dimensions are as indicated on shop drawings.

3.02 INSTALLATION

A. Install boards in accordance with manufacturer's instructions.

B. Secure units level and plumb.

3.03 CLEANING

A. Clean board surfaces in accordance with manufacturer's instructions.

B. Remove temporary protective cover at Date of Substantial Completion.

END OF SECTION

SECTION 10 1419 - DIMENSIONAL LETTER SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Dimensional letter signage.

1.02 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.

B. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

C. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. UL 879 - Electric Sign Components; Current Edition, Including All Revisions.

1.03 SUBMITTALS

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

B. Product Data: Manufacturer's product literature for each type of dimensional letter sign, indicating style, font, colors, locations, and overall dimensions of each sign.

C. Shop Drawings:

1. Include dimensions, locations, elevations, materials, text and graphic layout, and attachment details.

D. Verification Samples: Submit samples showing colors and finishes specified.

E. Manufacturer's Installation Instructions: Include installation templates and attachment devices.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Package dimensional letter signs as required to prevent damage before installation.

B. Store under cover and elevated above grade.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Dimensional Letter Signs:

1. FASTSIGNS International, Inc: www.fastsigns.com/#sle.
2. Inpro Corporation: www.inprocorp.com/#sle.
3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 DIMENSIONAL LETTERS

A. Applications: Building identification.

1. Use individual metal letters.
2. Mounting Location: Exterior as indicated on drawings.

B. Metal Letters:

1. Material: Pre-weathered steel, fabricated reverse channel.
2. Thickness: Manufacturer's standard for letter size.
3. Letter Height: As indicated on drawings.
4. Text and Typeface:

a. Character Font: Arial.

5. Finish: Natural.
6. Color: As selected.
7. Mounting: Concealed screws.

2.03 ACCESSORIES

A. Concealed Screws: Noncorroding metal; stainless steel, galvanized steel, chrome plated, or other.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

B. Notify Architect if conditions are not suitable for installation of signs; do not proceed until conditions are satisfactory.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install with horizontal edges level.

END OF SECTION

SECTION 10 1423 - PANEL SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Panel signage.

1.02 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

1.03 SUBMITTALS

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

B. Product Data: Manufacturer's product literature for each type of panel sign, indicating styles, font, foreground and background colors, locations, and overall dimensions of each sign.

C. Shop Drawings:

1. Include dimensions, locations, elevations, materials, text and graphic layout, attachment details, and schedules.
2. Schedule: Provide information sufficient to completely define each panel sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
    a. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
    b. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
    c. Submit for approval by Owner through Architect prior to fabrication.

D. Verification Samples: Submit samples showing colors, materials, and finishes specified.

E. Manufacturer's Installation Instructions: Include installation templates and attachment devices.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Package signs as required to prevent damage before installation.

B. Package room and door signs in sequential order of installation, labeled by floor or building.

C. Store under cover and elevated above grade.

D. Store tape adhesive at normal room temperature.

1.05 FIELD CONDITIONS

A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.

B. Maintain minimum ambient temperature during and after installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Panel Signage:

1. Best Sign Systems, Inc: www.bestsigns.com.
2. Inpro Corporation: www.inprocorp.com.
3. Mohawk Sign Systems, Inc: www.mohawksign.com.

4. Seton Identification Products: www.seton.com.
5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 REGULATORY REQUIREMENTS

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

2.03 PANEL SIGNAGE

A. Panel Signage:
1. Application: Room and door signs.
2. Description: Flat signs with engraved panel media, tactile characters.
3. Sign Size: As indicated on drawings.
4. Total Thickness: 1/8 inch (3 mm).
5. Color and Font, unless otherwise indicated:
a. Character Font: Helvetica, Arial, or other sans serif font.
b. Character Case: Upper and lower case (title case).
c. Background Color: As scheduled.
d. Character Color: Contrasting color.
6. Material: Laminated colored plastic engraved through face to expose core as background color.
7. Profile: Flat panel without frame.
a. Clear Cover: For customer produced sign media, provide clear cover of polycarbonate plastic, glossy on back, non glare on front.
8. Tactile Letters: Raised 1/32 inch minimum.
9. Braille: Grade II, ADA-compliant.
10. One-Sided Wall Mounting: Tape adhesive.

2.04 SIGNAGE APPLICATIONS

A. Room and Door Signs:
1. Provide per schedule on drawings.
2. Rest Rooms: Identify with pictograms, the names "MEN" and "WOMEN", room numbers to be determined later, and braille.

B. Interior Directional and Informational Panel Signs:
1. Directories: For customer-produced media; provide divider strips.
2. Where suspended, ceiling mounted, or projecting from wall signs are indicated, provide two-sided signs with same information on both sides.

2.05 ACCESSORIES

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

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

B. Notify Architect if conditions are not suitable for installation of signs; do not proceed until conditions are satisfactory.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install with horizontal edges level.

C. Locate panel signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.

END OF SECTION

SECTION 10 2113.19 - PLASTIC TOILET COMPARTMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Solid plastic toilet compartments.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Blocking and supports.

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

1.03 REFERENCE STANDARDS

A. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2024.

1.04 SUBMITTALS

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

B. Product Data: Provide data on panel construction, hardware, and accessories.

C. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings.

D. Samples: Submit two samples of partition panels, 6 x 6 inch (152 x 152 mm) in size illustrating panel finish, color, and sheen.

E. Manufacturer's Installation Instructions: Indicate special procedures.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Solid Plastic Toilet Compartments:

1. All American Metal Corp - AAMCO: www.allamericanmetal.com.
2. ASI Accurate Partitions: www.asi-accuratepartitions.com.
3. ASI Global Partitions: www.asi-globalpartitions.com.
4. Metpar Corp: www.metpar.com.
5. Sanymetal Products Company: www.sanymetal.com.
6. Scranton Products: www.scrantonproducts.com.
7. Substitutions: Section 01 6000 - Product Requirements.

2.02 PLASTIC TOILET COMPARTMENTS

A. Solid Plastic Toilet Compartments (COMP-1): Factory fabricated doors, pilasters, and divider panels made of solid molded high density polyethylene (HDPE), Class A, tested in accordance with NFPA 286; floor-mounted headrail-braced.

1. Color: As indicated on drawings.

B. Doors:

1. Thickness: 1 inch (25 mm).
2. Width: 24 inch (610 mm).
3. Width for Handicapped Use: 36 inch (915 mm), out-swinging.
4. Height: 55 inch (1397 mm).

C. Panels:

1. Thickness: 1 inch (25 mm).
2. Height: 55 inch (1397 mm).
3. Depth: As indicated on drawings.

D. Pilasters:
1. Thickness: 1 inch (25 mm).
2. Width: As required to fit space; minimum 3 inch (76 mm).

2.03 ACCESSORIES

A. Pilaster Shoes: Stainless steel, satin finish, 3 inches (76 mm) high; concealing floor fastenings.
1. Provide adjustment for floor variations with screw jack through steel saddles integral with pilaster.

B. Head Rails: Extruded aluminum, anti-grip profile.
1. Size: Manufacturer's standard size.

C. Wall and Pilaster Brackets: Stainless steel; manufacturer's standard type for conditions indicated on drawings.

D. Attachments, Screws, and Bolts: Stainless steel , tamper proof type.
1. For attaching panels and pilasters to brackets: Through-bolts and nuts ; tamper proof.

E. Hinges: Stainless steel, manufacturer's standard finish.
1. Pivot hinges, gravity type, adjustable for door close positioning; two per door.

F. Door Hardware: Stainless steel, manufacturer's standard finish.
1. Door Latch: Slide type with exterior emergency access feature.
2. Door Strike and Keeper with Rubber Bumper: Mount on pilaster in alignment with door latch.

G. Coat Hook with Rubber Bumper: One per compartment, mounted on door.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify correct spacing of and between plumbing fixtures.

C. Verify correct location of built-in framing, anchorage, and bracing.

3.02 INSTALLATION

A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.

B. Maintain 3/8 inch to 1/2 inch (9 mm to 13 mm) space between wall and panels and between wall and end pilasters.

C. Attach panel brackets securely to walls using anchor devices.

D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.

3.03 TOLERANCES

A. Maximum Variation From True Position: 1/4 inch (6 mm).

B. Maximum Variation From Plumb: 1/8 inch (3 mm).

3.04 ADJUSTING

A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch (5 mm).

B. Adjust hinges to position doors in partial opening position when unlatched. Return out-swinging doors to closed position.

C. Adjust adjacent components for consistency of line or plane.

END OF SECTION

SECTION 10 2600 - WALL AND DOOR PROTECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Corner guards.

B. Protective wall covering.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Blocking for wall and corner guard anchors.

1.03 REFERENCE STANDARDS

A. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics; 2010, with Editorial Revision (2015).

B. ASTM D543 - Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents; 2021.

C. ASTM F476 - Standard Test Methods for Security of Swinging Door Assemblies; 2023.

D. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

1.04 SUBMITTALS

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

B. Product Data: Indicate physical dimensions, features, wall mounting brackets with mounted measurements, anchorage details, and rough-in measurements.

C. Samples: Submit samples illustrating component design, configurations, joinery, color and finish.

1. Submit two sections of corner guards, 6 inches (152 mm) long.

D. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project:

1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Extra Stock Materials: One package(s) of minimum 96 inches (2438 mm) long unit of each kind of covers for corner guards.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver wall and door protection items in original, undamaged protective packaging. Label items to designate installation locations.

B. Protect work from moisture damage.

C. Protect work from UV light damage.

D. Do not deliver products to project site until areas for storage and installation are fully enclosed, and interior temperature and humidity are in compliance with manufacturer's recommendations for each type of item.

E. Store products in either horizontal or vertical position, in compliance with manufacturer's instructions.

1.06 WARRANTY

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

B. Manufacturer Warranty: Provide 5-year manufacturer warranty for metal crash rails. Complete forms in Owner's name and register with manufacturer.

1. Failures include, but are not limited to, the following:
    a. Structural failures or internal connection failures.
    b. Deterioration of materials beyond that expected of normal use, as intended by manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Corner Guards:
    1. Construction Specialties, Inc: www.c-sgroup.com.
    2. Inpro: www.inprocorp.com.
    3. Koroseal Interior Products: www.koroseal.com.
    4. Substitutions: See Section 01 6000 - Product Requirements.
B. Protective Wall Panels: Fiber Reinforced Laminate (FRL):
    1. Rampart: WolgGordon: www.wolfgordon.com.
    2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PERFORMANCE CRITERIA

A. Impact Strength: Unless otherwise noted, provide protection products and assemblies that have been successfully tested for compliance with applicable provisions of ASTM D256 and/or ASTM F476.
B. Chemical and Stain Resistance: Unless otherwise noted, provide protection products and assemblies with chemical and stain resistance complying with applicable provisions of ASTM D543.
C. Fungal Resistance: Unless otherwise noted, provide protection products and assemblies which pass ASTM G21 testing.

2.03 PRODUCT TYPES

A. Corner Guards - Surface Mounted (CG-1):
    1. Basis of Design: As indicated on drawings.
    2. Material: Type 304 stainless steel, No. 4 satin finish, 20 gauge, minimum thickness; surface mount.
B. Protective Wall Panels:
    1. Material: Fiber Reinforced Laminate (FRL): Thermofused melamine overlay, decorative paper and fire-rated phenolic paper with fiber reinforcing inner layers.
    2. Basis of Design: Rampart by WolfGordon.
        a. (WP-1): Color and Pattern: As indicated on drawings.
        b. ALTERNATE 11 - (WP-2): Color and Pattern: As indicated on drawings.
C. Adhesives and Primers: As recommended by manufacturer.
D. See Section 06 1000 for wood blocking for wall and corner guard anchors.

2.04 FABRICATION

A. Fabricate components with tight joints, corners and seams.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.
B. Verify that field measurements are as indicated on drawings.
C. Verify that substrate surfaces for adhered items are clean and smooth.

D. Start of installation constitutes acceptance of project conditions.

3.02 INSTALLATION

A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to supporting construction.

3.03 TOLERANCES

A. Maximum Variation From Required Height: 1/4 inch (6 mm).

B. Maximum Variation From Level or Plane For Visible Length: 1/4 inch (6 mm).

3.04 CLEANING

A. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.

B. Clean wall and door protection items of excess adhesive, dust, dirt, and other contaminants.

END OF SECTION

SECTION 10 2641 - BALLISTICS RESISTANT PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Laminated fiberglass ballistics-resistant panels.
B. Laminated aramid fiber ballistics-resistant panels.
C. Laminated UHMWPE fiber ballistics-resistant panels.
D. Steel ballistics-resistant panels.
E. Aluminum ballistics-resistant panels.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Wood framing to receive ballistics-resistant panels.
B. Section 06 4100 - Architectural Wood Casework: Casework to receive ballistics-resistant panels.
C. Section 09 2116 - Gypsum Board Assemblies: Metal framing to receive ballistics-resistant panels.

1.03 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018.
B. NIJ 0108.01 - Standard for Ballistic Resistant Protective Materials; 1985.
C. UL 752 - Standard for Bullet-Resisting Equipment; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Product Data: Manufacturer's current data sheets on each product to be used.
C. Shop Drawings: Details of installation of ballistics-resistant panels, including plan views, elevations, sections, and details of the proposed installation with attachment methods.

1.05 QUALITY ASSURANCE

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

1.06 DELIVERY, STORAGE, AND HANDLING

A. Handle material with care to prevent damage. Stack panels flat, store inside under cover off the ground in a dry location, and protect from other construction activities.

1.07 FIELD CONDITIONS

A. Install products under environmental conditions (temperature, humidity, and ventilation) recommended by manufacturer.

1.08 WARRANTY

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

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Laminated Glass Fiber Ballistics-Resistant Panels:
    1. ArmorCore by Waco Composites: www.armorcore.com.
    2. Armortex: www.armortex.com.
    3. Insulgard Security Products: www.insulgard.com.

4. Total Security Solutions: www.tssbulletproof.com.
5. U.S. Bullet Proofing: www.usbulletproofing.com/.
6. Substitutions: See Section 01 6000 - Product Requirements.

2.02 LAMINATED FIBER BALLISTICS-RESISTANT PANELS

A. General:
   1. Laminated fiber ballistics-resistant panels to be non-ricochet type. When struck by a bullet or projectile, the panels to delaminate in such a way that absorbs the energy, stops the projectile, and prevents ricochet or spalling.

B. Performance Requirements:
   1. Surface Burning Characteristics: Maximum flame spread index of 25 and smoke developed index of 450; when tested in accordance with ASTM E84.

C. Laminated Fiber Panels:
   1. Material: Multiple layers of fiberglass woven roving bonded together with resin and compressed into flat rigid sheets.
   2. Attachment Method: Mechanical fasteners.

D. Bullet Resistant Wall Panel (BAL PNL-3): Multi-ply laminated ballistic figerglass. Tested in accordance with UL 752 and NIJ standards.
   1. Application: Provide in casework and walls where bullet resistant panel is indicated in the drawings.
   2. Thickness: 1/2 inch, nominal.
   3. Ballistic Protection: Level 8.
   4. Basis of Design: USFA 3 Fiberglass Wall Armor by U.S. Bullet Proofing: usbulletproofing.com.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Verify that substrates have been properly prepared.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation of this work.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install panels in accordance with manufacturer's instructions and shop drawings and in proper relationship with adjacent construction.
   1. Maintain ballistics-resistive rating at panel junctures with concrete floor and roof slabs, bullet-resistive door and window frames, and required penetrations.

B. Reinforce panel joints with a minimum 4 inch (102 mm) wide back-up layer of ballistics-resistant material, centered on panel joints.

C. Secure panels using screws, bolts, or industrial adhesive.

3.04 PROTECTION

A. Protect installed panels from subsequent construction operations.

B. Touch-up, repair or replace damaged panels before Date of Substantial Completion.

END OF SECTION

SECTION 10 2800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Commercial toilet accessories.
B. Commercial shower and bath accessories.
C. Healthcare accessories.
D. Electric hand/hair dryers.
E. Diaper changing stations.

1.02 RELATED REQUIREMENTS

A. Section 10 2113.19 - Plastic Toilet Compartments.

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
B. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2024.
C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
D. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.
E. ASTM C1036 - Standard Specification for Flat Glass; 2025.
F. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2024.
G. ASTM F2285 - Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use; 2022.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.
C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Commercial Toilet, Shower, and Bath Accessories:
    1. American Specialties, Inc: www.americanspecialties.com.
    2. Bradley Corporation: www.bradleycorp.com.
    3. Bobrick Washroom Equipment Inc: www.bobrick.com.
    4. Substitutions: Section 01 6000 - Product Requirements.
B. Provide products of each category type by single manufacturer.

2.02 MATERIALS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.

1. Grind welded joints smooth.
2. Fabricate units made of metal sheet of seamless sheets with flat surfaces.

B. Stainless Steel Sheet: ASTM A666/A666M, Type 304.

C. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.

D. Galvanized Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.

E. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.

F. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.

2.03 FINISHES

A. Stainless Steel: Satin finish, unless otherwise noted.

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

2.04 COMMERCIAL TOILET ACCESSORIES

A. Toilet Paper Dispenser (TP-2): Double roll, surface-mounted, stainless steel unit with pivot hinge.
1. Basis of Design: Model 5234 manufactured by Bradley.

B. Paper Towel Dispenser (PTD-1): Folded paper type, stainless steel, surface-mounted, with viewing slots on sides as refill indicator and tumbler lock.
1. Basis of Design: Model 250-15 manufactured by Bradley.
2. Capacity: 500 multifold minimum.

C. Combo Paper Towel and Waste Container (COMB-1): Satin stainless steel; semi-recessed.
1. Basis of Design: Model 2252-10 manufactured by Bradley.

D. Soap Dispenser (SP-1): Liquid soap dispenser, wall-mounted, surface, with stainless steel cover and horizontal stainless steel tank and working parts; push type soap valve, check valve, and window gauge refill indicator.
1. Basis of Design: Model 6562 manufactured by Bradley.
2. Minimum Capacity: 40 ounces (1.2 liters).

E. Framed Mirrors (MIR-10): Stainless steel framed, tempered glass mirror.
1. Basis of Design: Essential Capsule Framed Mirror by Kohler: www.kohler.com.
2. Size: As indicated on drawings.

F. Grab Bars: Stainless steel.
1. Standard Duty Grab Bars:
a. Push/Pull Point Load: 250 pound-force (1112 N), minimum.
b. Dimensions: 1-1/2 inch (38 mm) outside diameter, minimum 0.05 inch (1.3 mm) wall thickness, concealed flange mounting, 1-1/2 inch (38 mm) clearance between wall and inside of grab bar.
c. Finish: Satin.
d. Length and Configuration (see drawings for which of the following are used):
1) (GB-18): 18 inches. Basis of Design 812 Series by Bradley.
2) (GB-36): 36 inches. Basis of Design 812 Series by Bradley.
3) (GB-42): 42 inches. Basis of Design 812 Series by Bradley.

G. Sanitary Napkin Disposal Unit (ND-1): Stainless steel, surface-mounted, self-closing door, locking bottom panel with full-length stainless steel piano-type hinge, removable receptacle.
1. Basis of Design: Model 4781-11 manufactured by Bradley.

H. Coat Hook (HK-1): Stainless steel, 3 inch (75 mm) extension from wall; rectangular-shaped bracket and backplate for concealed attachment, satin finish.
   1. Basis of Design: Model 9134 manufactured by Bradley.

2.05 COMMERCIAL SHOWER AND BATH ACCESSORIES

A. Shower Curtain Rod (ROD-1): Stainless steel tube, 1 inch (25 mm) outside diameter, 0.04 inch (1.0 mm) wall thickness, satin-finished, with 3 inch (75 mm) outside diameter, minimum 0.04 inch (1.0 mm) thick satin-finished stainless steel flanges, for installation with exposed fasteners.
   1. Basis of Design: Model 9539 manufactured by Bradley.

B. Shower Curtain (SCT-1):
   1. Material: Opaque vinyl, 0.008 inch (0.2 mm) thick, matte finish, with antibacterial treatment, flameproof and stain-resistant.
   2. Size: 36 by 72 inches (914 by 1830 mm), hemmed edges.
   3. Grommets: Stainless steel; pierced through top hem on 6 inch (150 mm) centers.
   4. Color: As selected from manufacturer's standard colors.
   5. Shower Curtain Hooks: Chrome-plated or stainless steel spring wire designed for snap closure.

C. Folding Shower Seat: (SST-1) Wall-mounted surface; welded tubular seat frame, structural support members, swing-down legs, hinges, and mechanical fasteners of Type 304 stainless steel, L-shaped, right hand seat.
   1. Basis of Design: Model 9569 manufactured by Bradley.
   2. Seat: Phenolic or polymeric composite one-piece seat or seat slats, of color as selected.
   3. Size: ADA Standards compliant.

2.06 HEALTHCARE ACCESSORIES

A. Specimen Pass-Thru Cabinet (SPEC-1): Pass-Thru cabinet with inter-lock mechanism and spill tray.
   1. Basis of Design: Model 9813 manufactured by Bradley.
   2. Material: Stainless steel.

B. Stainless Steel Shelf:
   1. (SHELF-1): Basis of Design: As indicated on drawings.
   2. (SHELF-2): Basis of Design: Model 7B-0082496 as manufactured by Bradley.
      a. Size: 8 inches deep x 24 inches long.
      b. Hooks: Quanity of 2.

2.07 ELECTRIC HAND/HAIR DRYERS

A. Electric Hand Dryers (HAND DRY-1): Traditional fan-in-case type, with downward fixed nozzle.
   1. Operation: Automatic, sensor-operated on and off.
   2. Mounting: Wall-mounted - surface.
   3. Cover: Epoxy painted steel or die-cast zinc alloy.
      a. Tamper-resistant screw attachment of cover to mounting plate.
   4. Wall Guard: Model #89B, antimicrobial wallguard.
   5. Air Velocity: 15,000 linear feet per minute (76 m/s), minimum.
   6. Fan Control: Field adjustable down to approximately half-speed.
   7. Total Wattage: 450 W, maximum; no heater.
   8. Supply Voltage: 240 V, single phase, 60 Hz, nominal.
   9. Warranty: 3 years.
   10. Electric Hand Dryer Products:

a. World Dryer Corporation; Slimdri: www.worlddryer.com/#sle.
b. Substitutions: Section 01 6000 - Product Requirements.

2.08 DIAPER CHANGING STATIONS

A. Diaper Changing Station: Wall-mounted folding diaper changing station for use in commercial toilet facilities, meeting or exceeding ASTM F2285.
1. Basis of Design (BCS-2): Model 962-11 manufactured by Bradley.
2. Material: Stainless steel.
3. Mounting: Surface.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 PREPARATION

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

3.03 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.
B. Install plumb and level, securely and rigidly anchored to substrate.
C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.

3.04 PROTECTION

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

END OF SECTION

SECTION 10 4400 - FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire extinguishers.

B. Fire extinguisher cabinets.

1.02 RELATED REQUIREMENTS

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

1.03 REFERENCE STANDARDS

A. FM (AG) - FM Approval Guide; Current Edition.

B. NFPA 10 - Standard for Portable Fire Extinguishers; 2022.

C. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 SUBMITTALS

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

B. Product Data: Provide extinguisher operational features, extinguisher ratings and classifications, color and finish, and anchorage details.

C. Shop Drawings: Indicate locations of cabinets, cabinet physical dimensions, and rough-in measurements for recessed cabinets.

D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.05 FIELD CONDITIONS

A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Extinguishers:

1. Activar Construction Products Group, Inc. - JL Industries: www.activarcpg.com.
2. Ansul, a Tyco Business: www.ansul.com.
3. Kidde, a unit of United Technologies Corp: www.kidde.com.
4. Pyro-Chem, a Tyco Business: www.pyrochem.com.
5. Substitutions: See Section 01 6000 - Product Requirements.

B. Fire Extinguisher Cabinets and Accessories:

1. Activar Construction Products Group, Inc. - JL Industries: www.activarcpg.com.
2. Larsen's Manufacturing Co: www.larsensmfg.com.
3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.

1. Provide extinguishers labeled by UL (DIR) or FM (AG) for purpose specified and as indicated.

B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
   1. Provide one fire extinguisher for each cabinet or bracket indicated on the drawings.
   2. Basis of Design: Cosmic by JL Industries.
   3. Class: A:B:C type.
   4. Size: 10 pound (4.54 kg).
   5. Finish: Baked polyester powder coat color as selected.
   6. Temperature range: Minus 40 degrees F (Minus 40 degrees C) to 120 degrees F (49 degrees C).

C. Dry Chemical Type Fire Extinguishers: Stainless steel tank, with pressure gauge.
   1. Class: K type.
   2. Temperature range: Minus 20 degrees F (Minus 29 degrees C) to 120 degrees F (49 degrees C).

2.03 FIRE EXTINGUISHER CABINETS

A. Fire-Rated Construction: Provide fire-rated cabinets in fire-rated walls (see drawings for locations).

B. Cabinet Configuration:
   1. Type:
      a. (FCAB-1): Fully recessed.
      b. (FCAB-2): Semi-recessed.
      c. (FCAB-3): Surface mounted.
   2. Size to accommodate accessories.
   3. Basis of Design: JL Industries "Ambassador Series" sized for 10 lb fire extinguisher.
   4. Projected Trim: Returned to wall surface, with 2-1/2 inch (63 mm) projection, and 1-3/4 inch (44 mm) wide face.
   5. Provide cabinet enclosure with right angle inside corners and seams, and with formed perimeter trim and door stiles.

C. Door: 0.036 inch (0.9 mm) metal thickness, reinforced for flatness and rigidity with nylon catch. Hinge doors for 180 degree opening with two butt hinges.

D. Door Glazing: Float glass, clear, 1/8 inch (3 mm) thick, and set in resilient channel glazing gasket.

E. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.

F. Fabrication: Weld, fill, and grind components smooth.

G. Finish of Cabinet Exterior Trim and Door: Baked enamel, color as selected.

H. Finish of Cabinet Interior: White colored enamel.

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. Secure rigidly in place.

C. Place extinguishers in cabinets.

END OF SECTION

SECTION 10 7500 - FLAGPOLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum Flagpoles.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete base and foundation construction.

1.03 REFERENCE STANDARDS

A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

B. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.

C. NAAMM FP 1001 - Guide Specifications for Design Loads of Metal Flagpoles; 2007.

1.04 SUBMITTALS

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

B. Product Data: Provide data on pole, accessories, and configurations.

C. Shop Drawings: Indicate detailed dimensions, base details, anchor requirements, and imposed loads.

D. Maintenance Data: Provide lubrication and periodic maintenance requirement schedules and instructions.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: Design flagpole foundation under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed the State in which the Project is located.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Spiral wrap flagpole with protective covering and pack in protective shipping tubes or containers.

B. Protect flagpole and accessories from damage or moisture.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Flagpoles:

1. Concord Industries, Inc: www.concordindustries.com.
2. Pole-Tech Co, Inc: www.poletech.com.
3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FLAGPOLES

A. Flagpoles: Designed in accordance with NAAMM FP 1001

1. Material: Aluminum.
2. Design: Cone tapered.
3. Mounting: Ground mounted type.
4. Nominal Height: 25 ft (9.14 m); measured from nominal ground elevation.
5. Halyard: Internal type.

B. Performance Requirements:

1. Wind Pressure Loading on Flagpole with Flag: Resistant without permanent deformation to 120 MPH wind speed, in accordance with NAAMM FP 1001; the factor of safety used is 2.5.

2.03 POLE MATERIALS

A. Aluminum: ASTM B221 (ASTM B221M) , 6063 alloy , T6 temper.

2.04 ACCESSORIES

A. Finial Ball: Aluminum, 6 inch (150 mm) diameter.

B. Truck Assembly: Cast aluminum; revolving, stainless steel ball bearings, non-fouling.

C. Cleats: 9 inch (230 mm) size, aluminum with galvanized steel fastenings, one per halyard.

D. Halyard: 5/16 inch (8 mm) diameter nylon, braided, white.

2.05 MOUNTING COMPONENTS

A. Foundation Tube Sleeve: AASHTO M 36M, corrugated 16 gage (1.5 mm) steel, galvanized, depth as recommended by manufacturer.

B. Pole Base Attachment: Flush; steel base with base cover.

2.06 FINISHING

A. Metal Surfaces in Contact With Concrete: Asphaltic paint.

B. Aluminum: Mill finish.

C. Finial: Gold anodized finish.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that concrete foundation is ready to receive work and dimensions are as indicated on shop drawings.

3.02 PREPARATION

A. Coat metal sleeve surfaces below grade and surfaces in contact with dissimilar materials with asphaltic paint.

3.03 INSTALLATION

A. Install flagpole , base assembly, and fittings in accordance with manufacturer's instructions.

B. Fill foundation tube sleeve with concrete specified in Section 03 3000.

C. Install foundation plate and centering wedges for flagpoles base set in concrete base and fasten.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1 inch (25 mm).

END OF SECTION

SECTION 11 6723 - SHOOTING RANGE EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shooting Range Equipment of the following types:
   1. Bullet Traps and Collection.
   2. Shooting Stalls.
   3. Baffles and Guards.
   4. Target Systems.
   5. Range Controls.

1.02 REFERENCE STANDARDS

A. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 2023, with Editorial Revision (2024).
B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018.
C. ASTM E108 - Standard Test Methods for Fire Tests of Roof Coverings; 2025.
D. ISO 9001 - Quality Management Systems — Requirements; 2015, with Amendment (2024).
E. ISO 14001 - Environmental Management Systems — Requirements with Guidance for Use; 2015.
F. UL 94 - Tests for Flammability of Plastic Materials for Parts in Devices and Appliances; Current Edition, Including All Revisions.
G. UL 752 - Standard for Bullet-Resisting Equipment; Current Edition, Including All Revisions.

1.03 REFERENCES

A. ASTM International (ASTM):
   1. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
   2. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Materials.
B. International Organization for Standardization (ISO):
   1. ISO 9001 - Quality Management.
   2. ISO 14001 - Environmental Management.
C. Underwriters Laboratories (UL):
   1. UL 94 - Standard for Safety of Flammability of Plastic Materials for Parts in Devices and Appliances.
   2. UL 121.
   3. UL 752 - Standard for Bullet-Resisting Equipment.

1.04 SUBMITTALS

A. Submit under provisions of Section 01300.
B. Product Data:
   1. Manufacturer's data sheets on each product to be used.
   2. Preparation instructions and recommendations.
   3. Storage and handling requirements and recommendations.
   4. Typical installation methods.

C. Shop Drawings: Include details of materials, construction, and finish. Include relationship with adjacent construction. Include all electrical data and connection details. Coordinate all details on drawings of the exact locations for mechanical work

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with a minimum 35 years documented experience.

B. Supplier shall have a current and valid ISO 9001 Quality Management System and an ISO 14001 Environmental Management System.

C. Installer Qualifications: Company specializing in performing Work of this section with Lead Supervisor / installer having a minimum two years documented experience with projects of similar scope and complexity.

1. Installation shall be under the direct supervision of the Manufacturer.

D. Source Limitations: Provide all products of this Section from a single manufacturing source to ensure compatibility and product performance capability.

1.06 PRE-INSTALLATION CONFERENCE

A. Convene a conference approximately two weeks before scheduled commencement of the Work. Attendees shall include Architect, Contractor and trades involved. Agenda shall include schedule, responsibilities, critical path items and approvals.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store and handle in strict compliance with manufacturer's written instructions and recommendations.

B. Deliver all equipment boxed or crated to provide protection during transit and job storage.

C. Inspect equipment upon delivery for damage. Minor damages may be repaired, provided the finish items are equal in all respects to new work and acceptable to the Owner and Architect; otherwise, remove and replace damaged items immediately.

D. Store equipment at the site under cover in a secured place. Store equipment off the floor and in a manner to promote air circulation. Avoid the use of non-vented plastic or canvas shelters that could create a humidity chamber.

1.08 PROJECT CONDITIONS

A. Projects Prime Contractor to maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.09 WARRANTY

A. Manufacturer's Warranty: Provide manufacturer's standard limited warranty for defects in workmanship and materials for a period of one year from the date of substantial completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer: InVeris Training Solutions, which is located at: 296 Brogdon Rd.; Suwanee, GA 30024; ASD Toll Free: 800-813-9046; Phone: 678-288-1090; Fax: 678-288-1515; Email: ITS-LESales@inveristraining.com; Web: www.inveristraining.com.

B. Substitutions: Not permitted.

C. Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.02 BULLET TRAPS AND COLLECTION

A. Basis of Design: GranTrap, Model LE7500-OT; as manufactured and supplied by InVeris Training Solutions.

1. Performance and Design Requirements
    a. Maximum Bullet Velocity: 3600 ft per sec 1199.69 yard (1097 meter) per sec).
    b. Maximum Bullet Energy: 3600 ft-lbs (4881 Nm).
2. Description: Designed for all small arms including handguns, shotguns, and rifles. Utilizes specialty treated rubber granulate made from recycled materials, that safely stops bullets and maintains their basic original shape, thus minimizing broken up lead particles released into the atmosphere. Allows recovery of largely intact spent rounds.
3. Depth: Minimum 12 feet (365.76 cm)4 inches (101.6 mm).
4. Height: 9 feet (274.32 cm). Standard.
5. Height: 12 feet (365.76 cm).
6. Height: 8 feet (243.84 cm). Use for low ceiling situations.
7. Front Surface: Slopped.
8. Construction: Stepped steel bedplate, steel box tube support frame.
    a. Self-supporting.
    b. Mechanically fastened.
    c. Upper holding bins shall be part of frame support assembly and not require overhead or rear wall support.
    d. Upper frame shall support the armor plate upper slope sheet and extend no less than 5 feet (152.4 cm) from the rear side of the trap assembly.
9. Upper Hopper Bin: Angled 3/8 inch (9.52 mm) AR500 armor plate slope sheet. Filled with replenishment rubber granulate (GranTex).
10. Bullet Trap Sidewalls: 3/8-inch 0.37 inch (9.5 mm) AR500 armor plate.
    a. AR500 Armor Plate. (Rifle): 3/8 inch (9.52 mm),
    b. AR500 Armor Plate. (HD Pistol /Light Rifle use): 1/4 inch (6.35 mm).
    c. HRS (Pistol use): 1/4 inch (6.35 mm).
    d. Height: 8 feet (243.84 cm).
    e. Depth: To match the depth of the bullet trap rubber.
    f. Seams: Vertical only.
11. Rubber Granules: GranTex.
    a. Chopped rubber, predominately free of cording, threads, steel belting pieces and cotton fibers. Nominal Rubber Size: 7/8 inch (22.22 mm).
    b. Captures fired rounds with little or no fragmentation or back-splatter.
    c. Fire retardant treated with treatment that meets ASTM E108 Class A standards.
    d. Meets ASTM E84 Class A requirements for flame spread and smoke development.
12. Bed Plate: 10-gauge steel, in a deep stepped configuration. Provides a safety barrier.
13. Impact Area Step Depth: Minimum 24 inches (609.6 mm).
14. Back-Up Safety Bin: Internal, separately enclosed, conveyor belt faced, rubber granule filled. Minimum 10 inches (254 mm) depth.
15. Capacity:
    a. Primary Impact Area: Minimum 8 cu ft (227 liters) per section.
    b. Replenishment Bin: Minimum 19 cu ft (538 liters) per section.
    c. Back-Up Safety Bin: Minimum 10 cu ft (283 liters) per section.

16. Finish: Primed and painted.

2.03 SHOOTING STALLS

A. Basis of Design: Model SafeZone Shooting Stalls as manufactured and supplied by InVeris Training Solutions.
    a. Black.
    b. Blue.
    c. Gray.
    d. Red.
    e. Transparent upper panel.
    f. Logo: As indicated on Drawings.
    g. Transparent Upper Panel Custom etching.
    h. Owner /Buyer to Provide template with desired image / logo / lettering.
    i. Include Glass edge lighting with multicolor LED and a controller.
2. Pistol Rated:
    a. Maximum Bullet Velocity: 1485 ft per sec 495.41 yard (453 meter) per sec).
    b. Maximum Bullet Energy: 1175 ft-lbs. (1593 Nm).
    c. Ballistic Rating, UL 752: Level 3.
3. Rifle Rated:
    a. Maximum Bullet Velocity: 3025 ft per sec 1008.31 yard (922 meter) per sec).
    b. Maximum Bullet Energy: 3048 ft-lbs. (4133 Nm).
    c. Ballistic Rating, UL 752: Level 8.
    d. EN 1063 BR6
4. Depth: 48 inches (1219.2 mm).
5. Features:
    a. Swing down shooter's shelf with a resilient surface, raised edges to prevent accidental drop off, and a recessed tray area.
    b. Acoustical blast shield extends to further shelter adjacent shooters.
    c. Site light illuminates the stall interior.

2.04 BAFFLES AND GUARDS

A. Basis of Design: Air-Space Baffle, Model CB4 and Containment Ceiling, Model SC12, Re-Directive Guard, Model RG as manufactured and supplied by InVeris Training Solutions.
1. Description: Baffles and Ceilings are comprised of mixed layered panels strategically engineered to contain a misdirected round via the wood facing, containing them within the air space chamber after striking the steel backing plate. Re-guards are bare steel panels typically used at the bullet trap end of the range.
2. Material: 3/8 inch (9.52 mm) thick, AR500 steel.
3. Features:
    a. Minimizes bullet splatter from exiting the panel or returning to the open range area.
    b. Ceiling, lights, ducts, pipes, and range equipment are protected downrange by a series of angled air- space baffles.
    c. Shelters the ceiling area and redirects rounds toward the bullet trap.
    d. Suspended the ceiling, at prescribed angles to the floor, starting at the firing line and extending downrange at the distance and locations as indicated on the drawings.
4. Rifle Rated.

5. Steel Re-directive Guard: Model RG, utilized for the furthest downrange panels nearest the rubber bullet trap.
6. Baffles and ceiling panels utilizing internal lumber frames and wooden 1/2 inch (12.7 mm) facings to be Fire Rated, Treated lumber.** If 2" WFB is not used**
7. Acoustic Material: Acoustical material applied to the panel surfaces to assist in noise reduction.
8. Approved Products: 1" WFB / Sonex / PEPP - Flame Spread – 5 or less (((ASTM E84))) / Smoke -0 (((ASTM E84)))

2.05 TARGET SYSTEMS

A. Basis of Design: XWT Wireless Monorail retrievable Target Carrier as manufactured and supplied by InVeris Training Solutions.
   1. Description: The next level of innovative range products available from InVeris Training Solutions. The quiet, smooth, low maintenance wireless carrier is easily operated and programmable, essential for successful training and usability.
   2. Features:
      a. Easily programmable through a wireless controller, allowing uncomplicated intuitive screen operation.
      b. Targets are locally controlled using the Lane Controller or from a control room area using the Primary Master Control Computer.
      c. Programmable maneuvers and scenarios for skill set development and effective training.
      d. Speed control options provide Advance and Retreat training exercises.
      e. Basic and advanced user interfaces support the operator's preferred courses of fire.
      f. Moves along a rail system, powered by an internal direct drive, dual motor system, with anti-static wheels for quieter, smoother operation.
      g. Unique closed track design provides smooth target transportation.
      h. Does not collect lead fragments, casings, and other debris.
      i. No drive cables or pulleys to break or replace.
      j. No bulky and noisy drive motors above the shooters head.
      k. No track mounted power feed rails or wires to be impacted and damaged.
      l. Closed track design so brass and debris does not interfere with target operation.
      m. Includes 3/8 inch (9.52 mm) AR500 Front Armor Plate Prow.
      n. Uses batteries with a positive locking battery connection and ergonomic battery placement and replacement.
      o. New charging and docking system improved contact design for faster and more reliable charging.
      p. Programmable distraction lighting integrates red, blue, and white LED target lighting, with muzzle flash simulation.
      q. Chassis features a side cover designed for wheel overhead protection and the prevention of brass drivetrain damage.
      r. Anti-static wheels eliminate the need for grounding hardware and reduces ESD challenges.
      s. Formed steel monorail track provides a stable platform for target transport.
      t. Durable, low profile target carrier with armored front plate made with 3/8 inch (9.52 mm) AR500 steel facing the shooter to limit damage from bullet impacts.
      u. Enclosed drive unit offers easy accessibility to motor components.
      v. Target holders attached to the target carrier for interchangeable offhand, kneeling, and prone shooting, and differing types of targets.

w. Suitable for handguns, submachine guns, and shotguns to allow a full spectrum of training and usage by customers.
x. Capable of holding bull's eye to full-size police silhouette targets.
y. On board Camera system.

2.06 RANGE CONTROLS

A. Basis of Design: RangeMaster 9000, RM9K as manufactured and supplied by InVeris Training Solutions.
1. Description: An easy to use range control system offering instructors and range personnel the ability to write, store and run training scenarios. These scenarios can also be downloaded to the individual control units at the firing line or to another controller.
2. Features:
a. Scenario files are easily retrieved and launched, with vivid display of real time range target conditions.
b. Targets are directed to initiate a command to travel, conceal, expose, or edge.
c. Displays all target locations, presentations, and other optional features via icons of changing colors and images on the computer screen.
d. Targets are shown in increments of feet, yards, or meters.
e. Can control any, all, or a combination of lanes with the simple click of the mouse with our Lane Manager software.
f. Displays the status of all lane ICU batteries on a single page and delivers a pop-up on the browser if the lane battery gets low.
g. Sets a time limit on the lane ICU. A configurable countdown timer flashes when remaining time drops below five minutes.
h. Displays a pop-up on the Lane Manager page when lane time drops below the five-minute limit.
i. Triggers the ICU into lock-down mode when time runs out, only allowing the carrier to come home.
j. Displays a Help button on the ICU, enabling a pop-up notification display. The Help notification can be enabled or disabled.
k. Turns on a light above the shooter's booth when the Help button is enabled. This light is controlled via a Wi-Fi enabled smart switch.
l. Works in administrative mode, allowing the range operator to reboot the ICU's individually or all ICU's simultaneously and upgrade the ICU firmware individually or all ICU's simultaneously.

B. Basis of Design: RangeMaster 10K, RM10K as manufactured and supplied by InVeris Training Solutions.
1. Description: Combines advanced wireless and touch screen technologies for convenience and flexibility in range control operations.
2. Features:
a. Complete system control is managed through portable tablet computers, allowing personnel to leave the control room while maintaining complete control of the range.
b. The control and portability equate to increased productivity, as range instructors devote attention to firearms instruction rather than range management from the confines of a control room.
c. Touchscreen controller utilizes the latest technology in an intuitive, easy-to-navigate manner.

d. Range personnel may choose from multiple options on one screen, including the menu bar, target commands and arrangement.
e. Accepted commands include friend, foe, and edge.
f. Random commands direct the target to present a complete, unexpected turn to the right or left, in increments of up to 360 degrees, allowing for real life scenarios and enhanced target training.
g. Power: Standard electrical connections
h. Power: Built-in generator, 20 KW power supply with fuel capacity for 30 hours of run time.
i. Input Power: 208 60 Hz 3 phase.
j. Input Power: 220 V single phase, 60 Hz.
k. Input Power: 220 V 50 Hz.
l. Lighting includes switched fixtures for general and service lighting at the firing line and target areas, and dimmable fixtures for target lighting arranged in banks for target exposure distance.
m. Operator room has both general lighting and dimmable track-lighting fixtures, and an exterior fixture above the stairs at the trailer entrance.
n. .

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until exterior locations, structure and installing surfaces have been properly prepared.
B. Verify that all supports, and other adjoining conditions have been installed and prepared in accordance with the Drawings.
C. If structure and installing surfaces preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.
B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install all equipment in accordance with manufacturer's instructions.
B. Equipment shall be assembled entirely by mechanical fasteners. No on-the-job cutting or welding is permitted.
C. Equipment shall be mounted to the floor or suitable concrete surfaces as shown on the Drawings.
D. All metal parts not otherwise finished shall be primed or painted.

3.04 FIELD QUALITY CONTROL

A. Field Inspection: Coordinate field inspection in accordance with appropriate sections in Division 01.
B. Manufacturer’s Services: Coordinate manufacturer’s services in accordance with appropriate sections in Division 01.

3.05 ADJUSTING

A. Test the functionality of all control systems, safety systems, target systems and control systems.
B. Correct any deficiencies and replace any equipment not operating as required.

3.06 CLEANING AND PROTECTION

A. Clean products in accordance with the manufacturer's recommendations.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 12 2400 - WINDOW SHADES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior manual roller shades.

1.02 REFERENCE STANDARDS

A. WCMA A100.1 - Standard for Safety of Window Covering Products; 2022.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week prior to commencing work related to products of this section; require attendance of affected installers.

1.04 SUBMITTALS

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

B. Product Data: Provide manufacturer's standard catalog pages and data sheets, including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and accessories.

C. Shop Drawings: Include shade schedule indicating size, location and keys to details, head, jamb and sill details, mounting dimension requirements for each product and condition, and operation direction.

D. Verification Samples: Minimum size 6 inches (150 mm) square, representing actual materials, color and pattern.

E. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of shop drawings.

G. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver shades in manufacturer's unopened packaging, labeled to identify each shade for each opening.

B. Handle and store shades in accordance with manufacturer's recommendations.

1.06 FIELD CONDITIONS

A. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.07 WARRANTY

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

B. Provide manufacturer's warranty from Date of Substantial Completion, covering the following:

1. Shade Hardware: One year.
2. Fabric: One year.
3. Aluminum and Steel Coatings: One year.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Interior Manually Operated Roller Shades:

1. Draper, Inc: www.draperinc.com.

2. Hunter Douglas Architectural: www.hunterdouglasarchitectural.com.
3. MechoShade Systems LLC: www.mechoshade.com.
4. SWFcontract, a division of Springs Window Fashions, LLC.: www.swfcontract.com.
5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ROLLER SHADES

A. General:
1. Provide shade system components that are easy to remove or adjust without removal of mounted shade brackets.
2. Provide shade system that operates smoothly when shades are raised or lowered.

B. Roller Shades (WT-1) - Basis of Design: As indicated on drawings.
1. Description: Single roller, manually operated fabric window shades.
a. Drop Position: Regular roll.
b. Mounting: Window jamb mounted.
c. Size: As indicated on drawings.
d. Fabric: As indicated under Shade Fabric article.
2. Brackets and Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.
a. Material: Steel, 1/8 inch (3 mm) thick.
b. Double Roller Brackets (WT-2): Configured for light-filtering and room-darkening shades in one opening.
1) Light-Filtering Fabric (1%): Room-side of opening.
2) Room-Darkening Fabric: Glass-side of opening.
3. Roller Tubes:
a. Material: Extruded aluminum.
b. Size: As recommended by manufacturer; selected for suitability for installation conditions, span, and weight of shades.
c. Fabric Attachment: Utilize extruded channel in tube to accept vinyl spline welded to fabric edge. Shade band to be removable and replaceable without removing roller tube from brackets or inserting spline from the side of the roller tube.
d. Capable of being removed and reinstalled without affecting roller shade limit adjustments.
4. Hembars: Designed to maintain bottom of shade straight and flat.
a. Style: Full wrap fabric covered bottom bar, flat profile with heat sealed closed ends.
b. Room-Darkening Shades: Provide a slot in bottom bar with wool-pile light seal.
5. Clutch Operator: Manufacturer's standard material and design integrated with bracket/brake assembly.
a. Provide a permanently lubricated brake assembly mounted on an oil-impregnated hub with wrapped spring clutch.
b. Brake must withstand minimum pull force of 50 lb (22.7 kg) in the stopped position.
c. Mount clutch/brake assembly on the support brackets, fully independent of the roller tube components.
6. Drive Chain: Continuous loop stainless steel beaded ball chain, 95 lb (43 kg) minimum breaking strength. Provide upper and lower limit stops.
a. Chain Retainer: Chain tensioning device complying with WCMA A100.1.
7. Accessories:

a. Fascia: Extruded aluminum, size as required to conceal shade mounting, attachable to brackets without exposed fasteners.
b. Color: As indicated on drawings.

2.03 SHADE FABRIC

A. Fabric: Nonflammable, color-fast, impervious to heat and moisture, and able to retain its shape under normal operation.
1. Basis of Design: As indicated on drawings.

2.04 ROLLER SHADE FABRICATION

A. Field measure finished openings prior to ordering or fabrication.
B. Dimensional Tolerances: Fabricate shades to fit openings within specified tolerances.
1. Vertical Dimensions: Fill openings from head to sill with 1/2 inch (13 mm) space between bottom bar and window stool.
2. Horizontal Dimensions - Inside Mounting: Fill openings from jamb to jamb.
C. At openings requiring continuous multiple shade units with separate rollers, locate roller joints at window mullion centers; butt rollers end-to-end.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine finished openings for deficiencies that may preclude satisfactory installation.
B. Start of installation shall be considered acceptance of substrates.

3.02 PREPARATION

A. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under the project conditions.
B. Coordinate with window installation and placement of concealed blocking to support shades.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions and approved shop drawings, using mounting devices as indicated.
B. Adjust level, projection, and shade centering from mounting bracket. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

3.04 CLEANING

A. Clean soiled shades and exposed components as recommended by manufacturer.
B. Replace shades that cannot be cleaned to "like new" condition.

3.05 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.
B. Demonstration: Demonstrate operation and maintenance of window shade system to Owner's personnel.
C. 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 training by manufacturer's authorized personnel at location designated by the Owner.

3.06 PROTECTION

A. Protect installed products from subsequent construction operations.

B. Touch-up, repair, or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 12 3600 - COUNTERTOPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Countertops for architectural cabinet work.

1.02 RELATED REQUIREMENTS

A. Division 22 - Plumbing fixtures, sinks.

1.03 REFERENCE STANDARDS

A. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018.

C. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014, with Errata (2016).

D. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.1; 2016, with Errata (2017).

E. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.

F. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

G. PS 1 - Structural Plywood; 2023.

1.04 SUBMITTALS

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

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Specimen warranty.

C. Shop Drawings: Complete details of materials and installation ; combine with shop drawings of cabinets and casework specified in other sections.

D. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.

E. Installation Instructions: Manufacturer's installation instructions and recommendations.

F. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

1.05 DELIVERY, STORAGE, AND HANDLING

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

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.06 FIELD CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.01 COUNTERTOPS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Solid Surfacing Countertops (SSM-#): Solid surfacing sheet or plastic resin casting over continuous substrate.

1. Basis of Design: See drawings for product information.
2. Flat Sheet Thickness: 1/2 inch (12 mm), minimum.
3. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
    a. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
    b. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
4. Other Components Thickness: 1/2 inch (12 mm), minimum.
5. Back and End Splashes: Same sheet material, square top; minimum 4 inches (102 mm) high.

C. Stainless Steel Countertops (SSTL CTOP-1): Type 304, stainless steel sheet; 16 gauge, 0.0625 inch (1.59 mm) nominal sheet thickness.

1. Finish: 4B satin brushed finish.

2.02 MATERIALS

A. Wood-Based Components:

1. Wood fabricated from old growth timber is not permitted.
2. Provide sustainably harvested wood, certified or labeled; see Section 01 6000 - Product Requirements.

B. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch (19 mm) thick; join lengths using metal splines.

C. Countertop Support Members: Furniture grade, epoxy powder coated steel.

1. Basis of Design: Rakks Model EH-1818FM with cover bracket as manufactured by Rangine Corporation or approved equal.

D. Bench Bracket: Concealed Bench Support Bracket; clear anodized:

1. Basis of Design: Rakks Model EH-1416BFM as manufactured by Rangine Corporation.

E. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.

2.03 FABRICATION

A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.

1. Join lengths of tops using best method recommended by manufacturer.
2. Fabricate to overhang fronts and ends of cabinets 1 inch (25 mm) except where top butts against cabinet or wall.
3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.

B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.

1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.

2. Height: 4 inches (102 mm), unless otherwise indicated.
3. Detail top of backsplash to allow scribing of backsplash to wall.

C. Solid Surfacing: Fabricate tops and wall panels up to 144 inches (3657 mm) long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.

D. Stainless Steel: Fabricate tops up to 144 inches (3,657 mm) long in one piece including nosings and back and end splashes; accurately fitted mechanical field joints in lengths over that dimension are permitted.
1. Weld joints; grind smooth and polish to match.
2. Provide stainless steel hat channel stiffeners, welded or soldered to underside, where indicated on drawings.
3. Provide wall clips for support of back/end splash turndowns.
4. Sound Deadening: Apply water resistant, fire resistant sound deadening mastic to entire bottom surface.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.

B. Attach stainless steel countertops using stainless steel fasteners and clips.

C. Attach countertops using compatible adhesive as well as mechanical fasteners.

D. Seal joint between back/end splashes and vertical surfaces.

3.04 CLEANING

A. Clean countertops surfaces thoroughly.

3.05 PROTECTION

A. Protect installed products until completion of project.

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

END OF SECTION

SECTION 14 2400 - HYDRAULIC ELEVATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Complete hydraulic elevator systems.
   1. Passenger type.
B. Elevator Maintenance Contract.

1.02 RELATED REQUIREMENTS

A. Section 04 2000 - Unit Masonry: Masonry hoistway enclosure; building-in and grouting hoistway door frames.
B. Section 05 5000 - Metal Fabrications: Includes elevator pit ladder, sill supports, and overhead hoist beams.
C. Section 07 8400 - Firestopping: Fire rated sealant in hoistway.
D. Section 09 6813 - Tile Carpeting: Floor finish in car.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
B. AISC 360 - Specification for Structural Steel Buildings; 2022, with Errata (2025).
C. ASME A17.1 - Safety Code for Elevators and Escalators Includes Requirements for Elevators, Escalators, Dumbwaiters, Moving Walks, Material Lifts, and Dumbwaiters with Automatic Transfer Devices; 2022.
D. ASME A17.2 - Guide for Inspection of Elevators, Escalators, and Moving Walks Includes Inspection Procedures for Electric Traction and Winding Drum Elevators, Hydraulic Elevators, Inclined Elevators, Limited-Use/Limited-Application Elevators, Private Residence Elevators, Escalators, Moving Walks, Dumbwaiters, and Material Lifts; 2023.
E. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.
F. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025.
G. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.
H. NEMA MG 00001 - Motors and Generators; 2024.
I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
J. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2025.
K. PS 1 - Structural Plywood; 2023.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate work with other installers to provide conduits necessary for installation of wiring including but not limited to:
      a. Elevator equipment devices remote from elevator machine room or hoistway.
      b. Elevator pit for lighting and sump pump.
      c. Fire alarm panel from controller cabinet.
B. Preinstallation Meeting: Convene meeting at least one week prior to start of this work.

1. Review schedule of installation, proper procedures and conditions, and coordination with related work.

C. Construction Use of Elevator: Not permitted.

1.05 SUBMITTALS

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

B. Product Data: Submit data on following items:
   1. Signal and operating fixtures, operating panels, and indicators.
   2. Car design, dimensions, layout, and components.
   3. Car and hoistway door and frame details.
   4. Electrical characteristics and connection requirements.

C. Shop Drawings: Include appropriate plans, elevations, sections, diagrams, and details on following items:
   1. Elevator Equipment and Machines: Size and location of driving machines, power units, controllers, governors, and other components.
   2. Hoistway Components: Size and location of car guide rails, buffers, jack unit and other components.
   3. Rail bracket spacing; maximum loads imposed on guide rails requiring load transfer to building structural framing.
   4. Clearances and over-travel of car.
   5. Locations in hoistway of traveling cables and connections for car lighting and telephone.
   6. Location and sizes of hoistway and car doors and frames.
   7. Electrical characteristics and connection requirements.
   8. Indicate arrangement of elevator equipment and allow for clear passage of equipment through access openings.

D. Samples: Submit samples illustrating car interior finishes, car and hoistway door and frame finishes, and handrail material and finish in the form of cut sheets or finish color selection brochures.

E. Testing Agency's Qualification Statement.

F. Initial Maintenance Contract.

G. Maintenance Contract: Submit proposal to Owner for standard one year continuing maintenance contract agreement in accordance with ASME A17.1 and requirements as indicated, starting on date initial maintenance contract is scheduled to expire.
   1. Indicate in proposal the services, obligations, conditions, and terms for agreement period and for renewal options.

H. Operation and Maintenance Data:
   1. Parts catalog with complete list of equipment replacement parts; identify each entry with equipment description and identifying code.
   2. Operation and maintenance manual.
   3. Schematic drawings of equipment and hydraulic piping, and wiring diagrams of installed electrical equipment with list of corresponding symbols to identify markings on machine room and hoistway apparatus.

I. Specimen warranty.

J. Executed warranty.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section and approved by elevator equipment manufacturer.

C. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of type specified in this section.

1.07 WARRANTY

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

B. Manufacturer Warranty: Provide 1-year manufacturer warranty for elevator operating equipment and devices. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hydraulic Elevator Manufacturers:
   1. Otis Elevator Company: www.otis.com.
   2. Schindler Elevator Corporation: www.schindler.com.
   3. ThyssenKrupp Elevator: www.thyssenkruppelevator.com.

B. Substitutions: See Section 01 6000 - Product Requirements.

C. Source Limitations: Provide elevator and associated equipment and components produced by the same manufacturer as the other elevator equipment used for this project and obtained from a single supplier.

2.02 HYDRAULIC ELEVATORS

A. Hydraulic Passenger Elevator:
   1. Basis of Design: Otis Hydrofit Machine-roomless Holeless Hydraulic Elevator 3510R.
   2. Hydraulic Elevator Equipment:
      a. Holeless hydraulic with cylinder mounted within hoistway.
   3. Drive System:
      a. Variable voltage variable frequency (VVVF) to modulate motor speed.
   4. Operation Control Type:
      a. Selective Collective Automatic Operation Control.
   5. Service Control Type:
      a. Standard service control only.
   6. Interior Car Height: 96 inch (2438 mm).
   7. Electrical Power: 208 volts; alternating current (AC); three phase; 60 Hz.
   8. Rated Net Capacity: 3500 lbs (1590 kgs).
   9. Rated Speed: 100 feet per minute (0.5 m per second).
   10. Hoistway Size: As indicated on drawings.
   11. Interior Car Platform Size: As indicated on drawings.
   12. Elevator Pit Depth: 60 inches or as indicated on drawings.
   13. Overhead Clearance at Top Floor: 152 inches or as indicated on drawings.
   14. Travel Distance: As indicated on drawings.
   15. Number of Stops: As indicated on drawings.
   16. Number of Openings: 1 Front; 1 Rear; as indicated on drawings.
   17. Hydraulic Equipment Location: Machine Roomless, located in shaft.

2.03 COMPONENTS

A. Elevator Equipment:
   1. Motors, Hydraulic Equipment, Controllers, Controls, Buttons, Wiring, Devices, and Indicators: Comply with NFPA 70.
   2. Guide Rails, Cables, Buffers, Attachment Brackets and Anchors: Design criteria for components includes safety factors in accordance with applicable requirements of Elevator Code, ASME A17.1.
   3. Buffers:
      a. Spring type for elevators with speed less than or equal to 200 fpm (1 m/sec).
   4. Lubrication Equipment:
      a. Provide grease fittings for periodic lubrication of bearings.
      b. Grease Cups: Automatic feed type.
      c. Lubrication Points: Visible and easily accessible.

B. Electrical Equipment:
   1. Motors: NEMA MG 1.
   2. Boxes, Conduit, Wiring, and Devices: As required by NFPA 70.
   3. Spare Conductors: Provide ten percent in extra conductors and two pairs of shielded audio cables in traveling cables.

2.04 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with ASME A17.1.

B. Accessibility Requirements: Comply with ADA Standards.

C. Perform structural steel design, fabrication, and installation in accordance with AISC 360.

D. Perform welding of steel in accordance with AWS D1.1/D1.1M.

E. Fabricate and install door and frame assemblies in accordance with NFPA 80 and in compliance with requirements of authorities having jurisdiction.

F. Perform electrical work in accordance with NFPA 70.

2.05 OPERATION CONTROLS

A. Elevator Controls: Provide landing operating panels and landing indicator panels.
   1. Landing Operating Panels: Metallic type, one for originating "Up" and one for originating "Down" calls, one button only at terminating landings; with illuminating indicators.
   2. Landing Indicator Panels: Illuminating.
   3. Comply with ADA Standards for elevator controls.

B. Interconnect elevator control system with building fire alarm and smoke alarm systems.

C. Door Operation Controls:
   1. Program door control to open doors automatically when car arrives at floor landing.
   2. Render "Door Close" button inoperative when car is standing at dispatch landing with doors open.
   3. Door Safety Devices: Moveable, retractable safety edges, quiet in operation; equipped with photo-electric light rays.

D. Provide "Firefighter's Emergency Operation" in accordance with ASME A17.1.
   1. Designated Landing: At first floor.

2.06 OPERATION CONTROL TYPE

A. Selective Collective Automatic Operation Control: Applies to car in single elevator shaft.
   1. Refer to description provided in ASME A17.1.

2. Automatic operation by means of one button in the car for each landing served and by "UP" and "DOWN" buttons at the landings.
3. Stops are registered by momentary actuation of landing car buttons without consideration of the number of buttons actuated or the sequence buttons are actuated, but the stops are made in the order that landings are reached in each direction of travel.
4. All "UP" landing calls are made when car is traveling in the up direction.
5. All "DOWN" landing calls are made when car is traveling in the down direction.
6. Uppermost and lowermost calls are answered as soon as they are reached without consideration of the car travel direction.

2.07 EMERGENCY POWER

A. Set-up elevator operation to run with elevator emergency power supply when the normal building power supply fails.
B. Elevator Emergency Power Supply: Supplied by battery backup; provide elevator system components as required for emergency power characteristics.
C. Emergency Lighting: Comply with ASME A17.1 elevator lighting requirements.
D. Provide operational control circuitry for adapting the change from normal to emergency power.
E. Upon transfer to emergency power, advance one elevator at a time to a pre-selected landing, stop car, open doors, disable operating circuits, and hold in standby condition.

2.08 MATERIALS

A. Stainless Steel Sheet: ASTM A666/A666M, Type 304; No. 4 Brushed finish unless otherwise indicated.
B. Plywood: PS 1, Structural I, Grade C-D or better, sanded.
C. Tile Carpet Flooring: See Section 09 6813.
D. Plastic Laminate: NEMA LD 3, Type HGS, color as selected by Architect from manufacturer's standard line of colors.

2.09 CAR AND HOISTWAY ENTRANCES

A. Elevator:
   1. Car and Hoistway Entrances, Main Elevator Lobby:
      a. Framed Opening Finish and Material: Alkyd enamel on steel.
      b. Car Door Material: Powder coat on steel, with rigid sandwich panel construction.
      c. Hoistway Door Material: Powder coat on steel, with rigid sandwich panel construction.

2.10 CAR EQUIPMENT AND MATERIALS

A. Elevator Car:
   1. Car Operating Panel: Provide main and auxiliary; flush-mounted applied face plate, with illuminated call buttons corresponding to floors served with "Door Open/Door Close" buttons, "Door Open" button, "Door Close" button, and alarm button.
      a. Panel Material: Integral with front return; one per car.
      b. Car Floor Position Indicator: Above door with illuminating position indicators.
      c. Locate alarm button where it is unlikely to be accidentally actuated; not more than 54 inch (1.372 m) above car finished floor.
   2. Finishes: As selected from Manufacturer's full range:
      a. Front Return Panel: Match material of car door.
      b. Door Wall: Stainless steel.
      c. Side Walls: Plastic laminate on plywood.

d. Rear Wall: Plastic laminate on plywood.

3. Hand Rail: Stainless steel, at all three sides. Provide open clearance space 1-1/2 inch (38 mm) wide to face of wall.
   a. Stainless Steel Finish: No. 4 Brushed.
4. Ceiling:
   a. Canopy Ceiling: Plastic laminate on plywood.
   b. Lighting: LED can lights.

B. Car Accessories:

1. Protective Pads: Canvas cover, padded with impact-resistant fill material, sewn with piping edges; fire resistant in compliance with ASME A17.1; brass grommets for supports, covering side and rear walls and front return, with cut-out for control panel; provide one set for each elevator.
   a. Color: As selected by Architect.
   b. Provide at least 4 inch (102 mm) clearance from bottom of pad to finished floor.
   c. Pad Supports: Stainless steel studs, and mounted from ceiling frame.

2.11 FINISHES

A. Powder Coat on Steel: Clean and degrease metal surface; apply one coat of primer; two coats of powder coat.

B. Finish Paint for Metal Surfaces: Alkyd enamel, semi-gloss, color as selected, complying with VOC limitations of authorities having jurisdiction (AHJ).

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting this work.

B. Verify that hoistway and pit are ready for work of this section.

C. Verify hoistway shaft and openings are of correct size and within tolerance.

D. Verify location and size of machine foundation and position of machine foundation bolts.

E. Verify that electrical power is available and of correct characteristics.

3.02 PREPARATION

A. Maintain elevator pit excavation free of water.

B. Maintain in-ground elevator shaft excavation free of water.

3.03 INSTALLATION

A. Coordinate this work with installation of hoistway wall construction.

B. Install system components, and connect equipment to building utilities.

C. Provide conduit, electrical boxes, wiring, and accessories; see Sections 26 0533.13 and 26 0583.

D. Install hydraulic piping between cylinder and pump unit.

E. Mount machines, motors, and pumps on vibration and acoustic isolators.

1. Place on structural supports and bearing plates.
2. Securely fasten to building supports.
3. Prevent lateral displacement.

F. Install hoistway, elevator equipment, and components in accordance with approved shop drawings.

G. Install guide rails to allow for thermal expansion and contraction movement of guide rails.

H. Accurately machine and align guide rails, forming smooth joints with machined splice plates.

I. Bolt brackets to inserts placed in concrete form work.

J. Install hoistway door sills, frames, and headers in hoistway walls; grout sills in place, set hoistway floor entrances in alignment with car openings, and align plumb with hoistway.

K. Fill hoistway door frames solid with grout; see Section 04 2000.

L. Structural Metal Surfaces: Clean surfaces of rust, oil or grease; wipe clean with solvent; prime two coats.

M. Wood Surfaces not Exposed to Public View: Finish with one coat primer; one coat enamel.

N. Adjust equipment for smooth and quiet operation.

3.04 TOLERANCES

A. Guide Rail Alignment: Plumb and parallel to each other in accordance with ASME A17.1 and ASME A17.2.

B. Car Movement on Aligned Guide Rails: Smooth movement, without any objectionable lateral or oscillating movement or vibration.

3.05 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Testing and inspection performed at discretion of regulatory agencies certified in accordance with ASME QEI 1.

1. Schedule tests with agencies and notify Owner and Architect.
2. Document regulatory agency tests and inspections in accordance with requirements.
3. Perform tests required by regulatory agencies.
4. Furnish test and approval certificates issued by authorities having jurisdiction.

C. Perform testing and inspection in accordance with requirements.

1. Perform tests as required by ASME A17.2.
2. Provide at least two weeks written notice of date and time of tests and inspections.
3. Supply instruments and execute specific tests.

3.06 ADJUSTING

A. Adjust for smooth acceleration and deceleration of car to minimize passenger discomfort.

B. Adjust with automatic floor leveling feature at each floor landing to reach 1/4 inch (6.4 mm) maximum from flush with sill.

3.07 CLEANING

A. Remove protective coverings from finished surfaces.

B. Clean surfaces and components in accordance with manufacturers written instructions.

3.08 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals for closeout submittals.

B. Demonstrate proper operation of equipment to Owner's designated representative.

C. Demonstration: Demonstrate operation of system to Owner's personnel.

1. Use operation and maintenance data as reference during demonstration.
2. Briefly describe function, operation, cleaning and maintenance of each component.

D. Training: Train Owner's personnel on cleaning and 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.

3.09 PROTECTION

A. Do not permit construction traffic within car after cleaning.
B. Protect installed products until Date of Substantial Completion.
C. Touch-up, repair, or replace damaged products and materials prior to Date of Substantial Completion.

3.10 MAINTENANCE

A. See Section 01 7000 - Execution and Closeout Requirements for additional requirements relating to initial maintenance service.
B. Provide Initial Maintenance Contract of elevator system and components in accordance with ASME A17.1 and requirements as indicated for 12 months from Date of Substantial Completion .
C. Perform maintenance contract services using competent and qualified personnel under the supervision and direct employ of the elevator manufacturer or original installer.
D. Maintenance contract services shall not be assigned or transferred to any agent or other entity without prior written consent of Owner.
E. Examine system components periodically.
F. Include systematic examination, adjustment, and lubrication of elevator equipment.
G. Maintain and repair or replace parts, whenever required, using parts produced by original equipment manufacturer.
H. Perform work without removing cars from use during peak traffic periods.
I. Provide emergency call back service during regular working hours throughout period of this maintenance contract.

END OF SECTION

SECTION 21 0500 - FIRE PROTECTION GENERAL PROVISIONS

PART 1 GENERAL

1.01 SUMMARY

A. Specification Format

1. These Specifications are written in imperative and abbreviated form. This imperative language of the technical sections is directed at the Contractors, unless specifically noted otherwise. Incomplete sentences shall be completed by inserting "shall", "the Contractor shall", and "shall be", and similar mandatory phrases by inference in the same manner as they are applied to notes on the Drawings. The words "shall be" shall be supplied by inference where a colon (:) is used within sentences or phrases. Except as worded to the contrary, perform all indicated requirements whether stated imperatively or otherwise.
2. Three Part Format
   a. "Part 1 - General": Covers those areas which relate to the Work, and which define the general administrative and technical requirements specific to a particular section.
   b. "Part 2 - Products": Defines, in detail, the acceptance equipment and materials to be incorporated into the Work.
   c. "Part 3 - Execution": Describes, in detail, the manner in which items covered by Part 2 are to be incorporated into the Work.
3. Where Codes, Specifications and Drawings are in conflict, the Contractor will be deemed to have bid the more expensive method. Refer all such discrepancies immediately to the Engineer prior to commencing related work.

B. Definitions

1. Furnish: Supply equipment as required by these Drawings and Specifications, delivered to the job site for installation or use by others.
2. Install: Fix in position for total operational use all apparatus as shown, specified or required. Provide all miscellaneous fittings and wiring supplies.
3. Or Approved Equal: Equipment or materials selected by Contractor subject to Engineer's acceptance.
4. Or Equivalent: Equipment or materials selected by Contractor matching the function and performance of equipment or materials listed.
5. Provide: Furnish and install in place, total and operational.
6. Complete/Completely: All pipes, fittings, ducts, wiring supplies, and accessories provided for the noted equipment from the equipment to the mains or noted termination points.

1.02 NOMENCLATURE

A. NICET: National Institute for Certification in Engineering Technologies.

B. Pipe sizes listed are nominal pipe sizes throughout this Division except where otherwise noted.

1.03 SCOPE OF WORK

A. The work covered by this Division consists in furnishing all labor, equipment, accessories and materials and in performing all operations necessary for the installation of the fire protection systems, in strict accordance with Division 21 of this Specification and applicable Drawings and subject to the terms and conditions of the Contract.

B. Work of this Division is subject to requirements of Instructions to Bidders, General Conditions, Supplementary Conditions, Division One, and all other sections of this Specification.

C. Examine site and all Contract documents prior to submittal of bid.

1. Submittal of a Bid shall indicate the Contractor has examined the Site and Drawings and has included all required allowances in this Bid. No allowance shall be made for errors resulting from the Contractor's failure to visit job sites and to review Drawings.

D. Division 21 Work: Includes the following system types:

1. Wet-Pipe Sprinkler System.
2. Fire Pumps and Controllers.

E. Delegated-Design: For sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data by a NICET Level III certified designer or licensed Professional Engineer responsible for their preparation.

1. Everything necessary for the complete and successful operation of this system, whether or not definitely specified on the Drawings shall be furnished and installed as if specified or indicated.

1.04 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design system for Class A, B, and C fires as appropriate for areas being protected, and include safety factor.

B. Fire-extinguishing system design shall be approved by authorities having jurisdiction and shall be in accordance to architectural drawings and code plans.

1.05 WORK BY OTHERS

A. Painting.

B. Wiring by Division 26.

C. Water Service into Building.

D. Exterior Fire Protection Mains.

E. Fire Hydrants.

1.06 ALTERNATES

A. Refer to Division 01 for Alternates.

1.07 CONTINGENCY

A. Refer to Division 01 for amount to include in Mechanical Bid.

1.08 SUBMITTALS

A. General:

1. Preferred Submittal Format: PDF, unless otherwise noted.
2. Preferred Submittal Nomenclature: Unless otherwise noted, PDF submittals are to be named according to the following:
    a. [Specification Section Number] – [Specification Name or Equipment Included]
3. Distribution: Unless otherwise noted, direct all correspondence concerning Division 21 submittals to:
    a. Derek Olesen
    b. PRAIRIE ENGINEERING, P.C.
    c. 1905 17TH STREET SE
    d. MINOT, ND 58701
    e. dolesen@prairieengineeringpc.com

B. Substitution and Prior Approval to Quote.
   1. Format and Content: Complete descriptive technical data on the proposed item consisting of model numbers, type, size and performance characteristics.
   2. Submission Timing: Minimum of 192 hours (eight days) prior to bid opening.
      a. Substitutions will not be permitted after bid opening except where such substitution is considered by the Engineer to be in the best interest of the Owner.
   3. Bidder Notification: Prior to bid opening via Addenda, sent to all planholders.
   4. Contractor Responsibility: This contractor will be responsible for all coordination, construction costs, and Architectural/Engineering design fees required to substitute equipment that has different characteristics than designed including weights, physical dimensions, clearances, mechanical characteristics, electrical characteristics, and other characteristics deemed important to the design by the Architect/Engineer.
   5. Alternative Format: Printed paper, two copies; Self-addressed, stamped envelope required for return reply.

C. Schedule of Values.
   1. Format and Content: When included with the Bid, at minimum the following categories shall be indicated:
      a. “Sprinkler Riser”
      b. “Controls”
      c. “Wet Pipe Suppression System”
   2. Submission Timing: Prior to first payment application.

D. Shop Drawings: Submit to Engineer via the Prime Contractor for each item indicated.
   1. Format and Content: Include catalog numbers, performance data, dimensions and other descriptive information.
   2. Contractor Review: Dated and signed cover sheet or review stamp for each Shop Drawing file to indicate thorough review. Email message text not acceptable.
   3. Non-Conforming: Returned to Contractor without review.
   4. Submission Timing: Prior to delivery of materials to job site.

E. Shop Drawings, Wet-pipe Sprinkler Systems:
   1. Include plans, elevations, sections, details, and attachments to other work.
   2. Wiring Diagrams: For power, signal, and control wiring.
   3. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.

F. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."

G. Record Drawings
   1. Format and Content: Paper copy of Drawings project site.
      a. As work progresses, Contractor's field supervisor shall mark Record Drawings in red pencil to indicate actual conditions of installation.
      b. Give particular attention to marking actual locations of underground piping.
      c. Affix all addendum and change order descriptions to appropriate record drawing sheet, utilizing spray adhesive.
      d. Make Record Drawings available to Engineer during project visitation.
   2. Submission Timing: Close of project with Record Manuals.

H. Spare Equipment and Devices
   1. Distribution: Owner.
   2. Format and Content: List quantities on contractor letterhead or invoice, obtain signature of Owner's representative acknowledging receipt, and include with each Record Manual.
   3. Submission Timing: Close of project with Record Manuals.

I. Operation and Maintenance Manuals
   1. Submission Timing: Close of project, as condition of its acceptance.
   2. Record Manual information shall be included for all equipment/material where Shop Drawings are required.
   3. Format and Content: Two copies, Loose-leaf hardcover binders, and in PDF format on CDs.
      a. List project name, date, Contractor's name, address and telephone number on exterior label of each Record Manual and CD or USB drive.
      b. Include an index sheet indicating subcontractor and subcontractor's phone number and each major piece of equipment, supplier and supplier's telephone number. Provide tabbed dividers indicating major groupings of equipment.
      c. Include a copy of the Shop Drawings.
      d. Include all installation, operation and maintenance data packaged with any equipment.
      e. Include all signed and dated final punch lists from walkthroughs performed by the Engineer.

1.09 APPLICATIONS FOR PAYMENT

A. Refer to Division 1 "Applications for Payment".

B. Provide one additional copy, sent directly to the Engineer.

C. Schedule of Values: At minimum, include items in Submittal article.

1.10 CHANGES TO CONTRACT

A. Any required changes to the contract after bid date shall be in accordance with General Conditions/Division 01 and this section. Where any discrepancies between the sections are encountered, the more restrictive section shall apply.

B. Proposed changes shall be accompanied with complete substantiating documentation.
   1. Provide an itemized list of quantities for materials, equipment, and supplies.
      a. Include unit costs for each item and extended price.
      b. Include unit labor for each item and extended time.
   2. Provide subcontractor proposals that include the same substantiating documentation.
   3. Provide quotations from suppliers for any specially ordered equipment.

C. Material costs shall be actual costs to the contractor, obtaining the materials through normal supply channels, including trade and quantity discounts. Utilizing "suggested pricing" from national pricing organizations for unit costs shall not be accepted. Upon request, the contractor or subcontractor shall submit evidence to substantiate the costs.

D. Labor units shall be industry accepted standard labor hours to perform one unit of work. If the work is being performed in a location that is not considered to be standard working conditions for that specific task, additional labor shall be itemized.

E. Labor rates shall be the actual rate paid for the workman category along with associated labor burden. Labor burden shall consist only of the mandatory fringe benefits, labor taxes, and labor insurances as affected by payroll. The owner reserves the right to reject any labor burden which is inconsistent with other similar contractors or where the fringe benefit cost is in excess of established labor agreements.

F. No additional markups shall be allowed for:

1. Field and/or office supervision/administration time.
2. Tool burden.
3. Shop burden.
4. Overhead/Profit applied to work performed by others.

G. Additional costs for travel and subsistence shall only be allowed if the proposal includes a request for extension of the completion date. Furthermore, those costs shall be proportional to the number of working days of the extension.

H. Subcontractors shall compute their costs in the same manner as the contractor. Subcontractors are subject to the same markup constraints as described herein.

I. For changes resulting in credit to the costs, no restocking fees for materials shall be applied by the contractor or subcontractors.

1.11 AUTHORITIES AND AGENCIES

A. All work will be installed for the approval and acceptance of the following:
1. Insurance Services Office
2. State Fire Marshall
3. Local Fire Inspection Office

B. Any permits for the installation or construction of any of the work included in this section, which are required by any of the Authorities or Agencies having jurisdiction, shall be obtained and paid for by the Fire Protection Contractor.

C. All inspections, examinations and tests of any of the work included in this section, which are required by any of the Authorities or Agencies having jurisdiction, shall be obtained and paid for by the Fire Protection Contractor.

1.12 QUALITY ASSURANCE

A. Qualifications of Installers
1. For installation and testing, use only trained licensed and experienced workmen familiar with items required and manufacturer's recommended methods.
2. In acceptance or rejection of installed work, no allowance will be made for lack of skill on the part of the workmen.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.13 WARRANTY

A. The entire Fire Protection installation, as specified under this Section of the Specifications, shall be guaranteed for one (1) year against defective equipment, materials and workmanship. The liability of the Fire Protection Contractor under this guarantee is limited to repair or replacement of fire protection defective equipment, materials or workmanship. The guarantee period is to begin on the date the equipment is placed in operation at the Owner's request for his convenience or from the date a successful acceptance test is made, whichever occurs first.

B. The guarantee shall not be construed as requiring the Fire Protection Contractor to render service or maintenance required in the normal operation of the equipment or to make repairs that may be needed due to normal wear and tear or the Owner's negligence, abuse or breakage.

1.14 TEMPORARY FACILITIES

A. Refer to Special Conditions and/or Division 1 for details of temporary facilities.

PART 2 PRODUCTS

2.01 MATERIAL

A. All material, equipment, valves and devices, installed or furnished under this Section, shall be listed or approved for use in the Fire Protection installation by the Authorities, Agencies, Codes and Standards named in this Section of the Specification.
   1. Underwriter's Laboratories - Approved Fire Protection Equipment List
   2. Factory Mutual Approved Equipment Manual

B. Material and equipment shall be as shown or specified. Provide material not specifically described but required for a complete and proper installation of the Work, subject to the acceptance of the Engineer.

C. Owner will not be liable for material installed in non-compliance with codes, standards, and these Contract Documents.

D. Fire Stop System material shall be by 3M “Fire Barrier”, Metacaulk, Hilti, Nelson Firestop Products, or AD Fire.

E. See Division 07 for further details on approved materials.

2.02 ELECTRIC WIRING

A. The Division 21 Contractor shall furnish and install all water flow switches, air pressure switches and alarms, valve supervisory switches, visual/audible alarms, fire pump and controller, control panels, pre-action detection devices, air compressor and controls, special controls and electrical devices as specified herein for proper operation of the equipment furnished.

B. The Division 23 Contractor shall furnish and install all ventilation equipment and dampers, unless otherwise noted in the Drawings or Specifications.

C. Division 26 Contractor shall furnish and install, as required, wiring to supervisory switches, flow switches and alarms; and power wiring to fire pump and controller; furnished separately by Division 21 Contractor, unless otherwise noted in Equipment Specifications.

PART 3 EXECUTION

3.01 GENERAL

A. Engineer, Architect, or Owner shall not be responsible for the means, methods, techniques, sequences or procedures of construction selected by Contractor.

B. Engineer, Architect, or Owner shall not be responsible for safety precautions and programs incidental to work of Contractor.

C. It is the sole responsibility of Contractor to initiate, maintain, and supervise all safety precautions and programs in connection with the Work.

D. In general, it is intended that piping be installed parallel to building lines, unless otherwise shown on the Drawings, and that equipment be located symmetrical with the architectural elements of the building.

E. Install piping above grid ceilings to allow easy removal of ceiling tiles. Install exposed piping as high as possible except where noted otherwise.

3.02 SURFACE CONDITIONS

A. Prior to work, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

B. Verify that work of this Division may be installed in accordance with all pertinent codes, regulations and standards.

3.03 PRODUCT HANDLING

A. Protection: Use all means necessary to protect the materials of this Division before, during and after installation and to protect the installed work and materials of all other trades.

B. Plugs: Install in ends of uncompleted piping at end of each day or when work stops.

C. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Engineer and at no additional cost to the Owner.

3.04 COORDINATION

A. Order equipment and material in a timely fashion to assure it is on the job site when required.

B. Coordinate installation of material with schedule of other trades to prevent unnecessary delay in construction schedule.

C. Coordinate pipe routing with other trades to avoid conflicts with ductwork and other piping system.

D. Division 21 piping and equipment installations shall comply with National Electrical Code requirements 110.26 "working spaces" and "dedicated spaces". Pipes shall not be installed in the space near electrical panels/equipment de fined as "working spaces" or "dedicated spaces".

3.05 DISCREPANCIES, CONSTRUCTION CONFLICTS AND DRAWINGS

A. Discrepancies

1. Prior to submitting bid, Contractor shall refer any apparent discrepancies or omissions to Engineer for clarification.
2. The Architect, Engineer or Owner will not be responsible for any oral instructions or modifications to the contract documents prior to opening of bids.
3. Written interpretation or clarification will be made by Addenda.

B. Construction Conflicts

1. Conflicts discovered during construction shall be immediately called to the attention of the Engineer for decision.
2. Do not proceed with installation in area of question until conflict has been fully resolved.
3. When so directed by Engineer, Contractor shall make minor adjustment to avoid interferences with other trades. Such minor adjustments shall be performed at no additional cost to the Architect, Engineer or Owner.

C. Drawings

1. Refer to the architectural drawings for dimensions and locations of walls, partitions, doors, windows, ceiling heights, door swings and other details of construction.

3.06 UNDERGROUND UTILITIES

A. Locations of existing underground utilities are based on available site information and are shown approximately. Contractor shall determine exact utility locations before commencing work and shall be responsible for repair of damages resulting from his construction activities.

B. Trench and backfill for installation of underground piping to depth shown or required. Remove any accumulated water in excavation by pumping. Shore and brace excavation as required by safety regulations. Provide temporary bridges to maintain normal traffic flow. Excavation and backfill required by mechanical installations shall be accomplished in accordance with Division 31 Specifications by this Contractor.

3.07 CUTTING AND PATCHING

A. Refer to General Conditions. Unless specifically called out to be performed by other Contractors, the Division 21 Contractor shall perform all cutting and patching required for the installation of material and equipment furnished under his Contract.

B. Opening/holes cut to allow passage of pipes through concrete floor shall be patched by the Contractor doing the cutting unless indicated otherwise on the Drawings.

C. Fire-Barrier Penetrations

1. Pipe penetrations through fire rated walls and floors shall be sealed with a UL classified Fire Stop System. Fire Stops shall be provided in accordance with the appropriate System No. as it relates to pipe size/Material and wall or floor rating/material.
2. See Specification Section 210510 for other Fire-Barrier Penetration requirements.
3. See Section 2 article “Materials” of this Specification for approved fire stop system material.

D. Restore damaged surfaces to their original condition by skilled mechanics of the trade involved. Contractor at fault shall assume all cost.

E. Use only rotary type drilling tools to cut concrete.

F. Do not endanger the stability of the structure. Do not at any time cut or alter work of any other Contractor without Architect's consent.

3.08 FIELD QUALITY CONTROL

A. Perform field tests and inspections. Test new piping and parts of existing piping that have been altered, extended, or repaired.

B. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained. Piping will be considered defective if it does not pass tests and inspections.

3.09 INSTRUCTIONS

A. Provide written and oral operating and maintenance instructions to Owner's representatives. The oral instructions shall be given before the Owner occupies the buildings. Written instructions shall be graphical insofar as practical.

B. Division 21 Contractor shall coordinate with Owner at Owner's convenience, formal instruction time for contractor personnel to instruct Owner's Representatives on all equipment.

END OF SECTION

SECTION 21 0510 - COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Above ground piping.
B. Buried piping.
C. Escutcheons.
D. Fire rated enclosures.
E. Mechanical couplings.
F. Mechanical pressed fittings.
G. Pipe hangers and supports.
H. Pipe sleeves.
I. Pipe sleeve-seal systems.
J. Piping specialties.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.
B. Section 21 1300 - Fire-Suppression Sprinkler Systems: Sprinkler systems design.

1.03 REFERENCE STANDARDS

A. ASME A112.18.1 - Plumbing Supply Fittings; 2024.
B. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2023, with Errata (2024).
C. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2020.
D. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2021.
E. ASME B16.4 - Gray Iron Threaded Fittings: Classes 125 and 250; 2021.
F. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard; 2020.
G. ASME B16.9 - Factory-Made Wrought Buttwelding Fittings; 2018.
H. ASME B16.11 - Forged Fittings, Socket-Welding and Threaded; 2021.
I. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.
J. ASME B16.25 - Buttwelding Ends; 2022.
K. ASME B36.10M - Welded and Seamless Wrought Steel Pipe; 2022.
L. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2022).
M. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2024.
N. ASTM A135/A135M - Standard Specification for Electric-Resistance-Welded Steel Pipe; 2021.
O. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2024.
P. ASTM A536 - Standard Specification for Ductile Iron Castings; 2024.
Q. ASTM A795/A795M - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use; 2021.

R. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.
S. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2020.
T. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2023a.
U. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).
V. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; 2018.
W. AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings; 2021.
X. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; 2023.
Y. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast; 2023.
Z. AWWA C606 - Grooved and Shouldered Joints; 2022.
AA. NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

A. See Section 210500 Fire Protection General Provisions for submittal procedures.
B. Product Data: Provide manufacturer's catalog information. Indicate valve data and ratings.
C. Shop Drawings: Indicate pipe materials used, jointing methods, supports, and floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.
D. Installer's qualification statement.
E. Project Record Documents: Record actual locations of components and tag numbering.
F. Operation and Maintenance Data: Include installation instructions and spare parts lists.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Sprinkler-based System:
   1. Comply with NFPA 13.
   2. See Section 21 1300.
B. Welding Materials and Procedures: Comply with ASME BPVC-IX.
C. Provide system pipes, fittings, sleeves, escutcheons, seals, and other related accessories.

2.02 BURIED PIPING

A. Steel Pipe: ASTM A53/A53M Schedule 40, ASTM A135/A135M Schedule 10, ASTM A795/A795M Standard Weight, or ASME B36.10M Schedule 40, black, with AWWA C105/A21.5 polyethylene jacket, or double layer, half-lapped polyethylene tape.
   1. Steel Fittings: ASME B16.9, wrought steel, buttwelded, ASME B16.25, buttweld ends, ASTM A234/A234M, wrought carbon steel or alloy steel, ASME B16.5, steel flanges and fittings, or ASME B16.11, forged steel socket welded and threaded; with double layer, half-lapped polyethylene tape.
   2. Cast Iron Fittings: ASME B16.1, flanges and flanged fittings.
   3. Joints: Welded in accordance with AWS D1.1/D1.1M.
   4. Casing: Closed glass cell insulation.
B. Ductile Iron Pipe: AWWA C151/A21.51.
   1. Fittings: AWWA C110/A21.10, standard thickness.
   2. Joints: AWWA C111/A21.11, styrene-butadiene rubber (SBR) or vulcanized SBR gasket.
   3. Mechanical Couplings: Shaped composition sealing gasket, steel bolts, nuts, and washers.

2.03 ABOVE GROUND PIPING

A. Steel Pipe: ASTM A795 Schedule 40, black.
   1. Steel Fittings: ASME B16.5 steel flanges and fittings.
   2. Cast Iron Fittings: ASME B16.1, flanges and flanged fittings and ASME B16.4, threaded fittings.
   3. Malleable Iron Fittings: ASME B16.3, threaded fittings and ASTM A47/A47M.
   4. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.
   5. Mechanical Formed Fittings: Carbon steel housing with integral pipe stop and O-ring pocked and O-ring, uniformly compressed into permanent mechanical engagement onto pipe.

B. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), H58 drawn.
   1. Fittings: ASME B16.18, cast copper alloy, grooved.
   2. Mechanical Grooved Couplings: Ductile iron housing with alkyd enamel paint coating clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers.

C. Ductile Iron Pipe: AWWA C151/A21.51.
   1. Fittings: AWWA C110/A21.10, standard thickness.
   2. Joints: AWWA C111/A21.11, SBR or vulcanized styrene-butadiene rubber gasket.
   3. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped composition sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.

2.04 PIPE SLEEVES

A. Vertical Piping:
   1. Sleeve Length: 1 inch above finished floor.
   2. Provide sealant for watertight joint.

B. Plastic, Sheet Metal, or Moisture-Resistant Fiber: Pipe passing through interior walls, partitions, and floors, unless steel or brass sleeves are specified below.

C. 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.

D. Clearances:
   1. Wall, Floor, Floor, Partitions, and Beam Flanges: 1 inch greater than external; pipe diameter.
   2. Rated Openings: Caulked tight with firestopping material complying with ASTM E814 in accordance with Section 07 8400 to prevent the spread of fire, smoke, and gases.

2.05 PIPE SLEEVE-SEAL SYSTEMS

A. Modular Mechanical Seals:
   1. Elastomer-based interlocking links to 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. Service Requirements:
      a. Corrosion resistant.
      b. Underground, buried, and wet conditions.
   5. Glass-reinforced plastic pressure end plates.

B. Wall Sleeve: PVC material with waterstop collar, and nailer end caps.

C. Sleeve-Forming Disk: Nonconductive plastic-based material, 3 inch thick.

D. Pipeline-Casing Seals:

1. End Seals: 1/8 inch, pull-on type, rubber or synthetic rubber based.

2.06 FIRE-RATED ENCLOSURES

A. Provide as required to preserve fire resistance rating of building elements.

2.07 ESCUTCHEONS

A. Material:

1. Chrome-plated.
2. Metals and Finish: Comply with ASME A112.18.1.

B. Construction:

1. One-piece for mounting on chrome-plated tubing or pipe and one-piece or split-pattern type elsewhere.
2. Internal spring tension devices or setscrews to maintain a fixed position against a surface.

2.08 PIPE HANGERS AND SUPPORTS

A. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.

B. Hangers for Pipe Sizes 2 inches and Over: Carbon steel, adjustable, clevis.

C. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

D. Wall Support for Pipe Sizes to 3 inches: Cast iron hook.

E. Wall Support for Pipe Sizes 4 inches and Over: Welded steel bracket and wrought steel clamp.

F. Vertical Support: Steel riser clamp.

G. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

H. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

2.09 MECHANICAL COUPLINGS

A. Rigid Mechanical Couplings for Grooved Joints:

1. Dimensions and Testing: Comply with AWWA C606.
2. Minimum Working Pressure: 300 psig.
3. Housing Material: Fabricate of ductile iron complying with ASTM A536.
4. Housing Coating: Factory applied orange enamel.
5. Gasket Material: EPDM suitable for operating temperature range from minus 30 degrees F to 230 degrees F.
6. Bolts and Nuts: Hot-dipped-galvanized or zinc-electroplated steel.

2.10 MECHANICAL PRESSED FITTINGS

A. Provide double-pressed type, utilizing EPDM, nontoxic, synthetic rubber sealing elements for use with Schedule 40 carbon steel piping.

2.11 PIPING SPECIALTIES

A. Backflow Preventer: Double-check valve assembly backflow preventer with drain and OS & Y gate valve or butterfly valve on each end.

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.

C. Prepare piping connections to equipment with flanges or unions.

3.02 INSTALLATION

A. Install sprinkler system and service main piping, hangers, and supports in accordance with NFPA 13.

B. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

C. Install piping to conserve building space, to not interfere with use of space and other work.

D. Group piping whenever practical at common elevations.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

F. Pipe Hangers and Supports:

1. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
2. Place hangers within 12 inches of each horizontal elbow.
3. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
4. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
6. Provide copper plated hangers and supports for copper piping.

G. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.

H. Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc-rich primer to welding.

I. Provide sleeves when penetrating footings, floors, walls, and partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.

1. All Rated Openings: Caulk tight with firestopping material complying with ASTM E814 in accordance with Section 07 8400 to prevent the spread of fire, smoke, and gases.

J. 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 watertight seal.
6. Install in accordance with manufacturer's recommendations.

K. Escutcheons:

1. Install and firmly attach escutcheons at piping penetrations into finished spaces.
2. Provide escutcheons on both sides of partitions separating finished areas through which piping passes.
3. Use chrome plated escutcheons in occupied spaces and to conceal openings in construction.

L. 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, unions, 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 21 0513 - COMMON MOTOR REQUIREMENTS FOR FIRE SUPPRESSION EQUIPMENT

<<<< UPDATE NOTES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General construction and requirements.
B. Applications.
C. Three phase electric motors.

1.02 RELATED REQUIREMENTS

A. Division 26.

1.03 REFERENCE STANDARDS

A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; 2015 (Reaffirmed 2020).
B. IEEE 112 - IEEE Standard Test Procedure for Polyphase Induction Motors and Generators; 2017.
C. NEMA MG 00001 - Motors and Generators; 2024.
D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

A. See Division 01 for submittal procedures.
B. Product Data: Provide wiring diagrams with electrical characteristics and connection requirements.
C. Manufacturer's Installation Instructions: Indicate setting, mechanical connections, lubrication, and wiring instructions.
D. Operation Data: Include instructions for safe operating procedures.
E. Maintenance Data: Include assembly drawings, bearing data including replacement sizes, and lubrication instructions.

1.05 QUALITY ASSURANCE

A. Comply with NFPA 70.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.

1.07 WARRANTY

A. See Division 01 for additional warranty requirements.
B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace VFDs that fail in materials or workmanship within specified warranty period.
    1. Warranty Period: Two years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following or other prior approved:
   1. Baldor Electric Company/ABB Group: www.baldor.com.
   2. Leeson Electric Corporation: www.leeson.com.
   3. Regal-Beloit Corporation (Century): www.centuryelectricmotor.com.
   4. Siemens: www.siemens.com.
   5. General Electric: www.ge.com.
   6. Marathon: www.marathon-motors.com.
   7. WEG: www.weg.net.
   8. TECO: www.tecomotors.com.
   9. NIDEC: www.nidec.com.

2.02 GENERAL CONSTRUCTION AND REQUIREMENTS

A. Electrical Service:
   1. Motors 3/4 HP and Smaller: 120 volts, single phase, 60 Hz.
   2. Motors Larger than 3/4 Horsepower: 208 volts, three phase, 60 Hz.

B. Nominal Efficiency: Based on motor size as indicated below, and shall comply with ASHRAE 90.1, whichever is greater.
   1. 3/4 HP and Smaller Single Phase: 75.0%.
   2. 1 HP amd Smaller Three Phase: 81.5%.
   3. Above 1 HP up to 5 HP: 86.5%.
   4. Above 5 HP: 91.0%.

C. Construction:
   1. Open drip-proof type except where specifically noted otherwise.
   2. Design for continuous operation in 105 degrees F environment at altitude of 3500 feet above sea level.
   3. Design for temperature rise in accordance with NEMA MG 00001 limits for insulation class, service factor, and motor enclosure type.

D. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, efficiency.

E. Wiring Terminations:
   1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.
   2. For fractional horsepower motors where connection is made directly, provide threaded conduit connection in end frame.

2.03 APPLICATIONS

2.04 THREE PHASE POWER - SQUIRREL CAGE MOTORS

A. Starting Torque: Between 1 and 1-1/2 times full load torque.

B. Starting Current: Six times full load current.

C. Power Output, Locked Rotor Torque, Breakdown or Pull Out Torque: NEMA Design B characteristics.

D. Design, Construction, Testing, and Performance: Comply with NEMA MG 00001 for Design B motors.

E. Insulation System: NEMA Class B or better.

F. Testing Procedure: In accordance with IEEE 112. Load test motors to determine free from electrical or mechanical defects in compliance with performance data.

G. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.

H. Thermistor System (Motor Frame Sizes 254T and Larger): Three PTC thermistors embedded in motor windings and epoxy encapsulated solid state control relay for wiring into motor starter; refer to Section 26 2913.

I. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA STD 9, L-10 life of 20,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.

J. Sound Power Levels: To NEMA MG 00001.

K. Part Winding Start Above 254T Frame Size: Use part of winding to reduce locked rotor starting current to approximately 60 percent of full winding locked rotor current while providing approximately 50 percent of full winding locked rotor torque.

L. Weatherproof Epoxy Sealed Motors: Epoxy seal windings using vacuum and pressure with rotor and starter surfaces protected with epoxy enamel; bearings double shielded with waterproof non-washing grease.

M. Nominal Efficiency: As indicated at full load and rated voltage when tested in accordance with IEEE 112.

N. Nominal Power Factor: As indicated at full load and rated voltage when tested in accordance with IEEE 112.

2.05 THREE-PHASE MOTORS USED WITH VARIABLE FREQUENCY DRIVES

A. Description: Additional requirements for three-phase motors used with variable frequency drives (VFD).

B. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

C. Motors Used with Variable Frequency Controllers:

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
2. Inverter-Duty Motors: Class F temperature rise; Class H insulation.

2.06 SHAFT GROUNDING RINGS

A. Description: Conductive microfiber shaft grounding ring.

1. Meet NEMA MG-1 requirements.
2. Factory installed whenever possible.

B. Basis of Design: AEGIS, model SGR.

C. Type: Minimum of two rows of circumferential fibers on solid ring or split ring.

D. Application Note: Provide on motors greater than 1 HP.

1. Motors less than 100 HP: Mount ring on either the drive end or non-drive end.

2. Motors 100 HP and above: Two shaft grounding rings, mounted on the drive end and the non-drive end.

2.07 ELECTRONICALLY COMMUTATED MOTORS

A. Description: Brushless DC motor with built in speed and torque controls.

B. Rotor: Permanent magnet.

C. Circuitry: Programmable, manage commutation of stator to be always synchronous with rotor.

D. Multispeed Motors: Minimum turndown of 80%.

E. Efficiency: Minimum of 65%.

F. Bearings: Permanently lubricated, heavy duty ball bearings.

G. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

2.08 VARIABLE FREQUENCY DRIVES

A. Description: Variable-frequency power converter (rectifier, dc bus, and IGBT, PWM inverter).

1. Units suitable for operation of inverter-duty motors as defined by NEMA MG 1, Section IV, Part 31, "Definite-Purpose Inverter-Fed Polyphase Motors."

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:

1. ABB.
2. Cerus Industrial.
3. Danfoss Inc.; Danfoss Drives Div.
4. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
5. General Electric Company.
6. Rockwell Automation, Inc.; Allen-Bradley Brand.
7. Square D; a brand of Schneider Electric.
8. Toshiba International Corporation.

C. VFD General Requirements: Comply with NEMA ICS 7, NEMA ICS 61800-2.

D. Integral Disconnect: Disconnect shall remove all power from unit.

E. Application: Variable torque.

F. Design and Rating: Match load type, such as fans, blowers, and pumps; and type of connection used between motor and load such as direct or through a power-transmission connection.

G. Unit Operating Requirements:

1. Input AC Voltage Tolerance: Plus 10% and minus 15% of VFD input voltage range rating; +/- 5% of VFD frequency rating.
2. Output Rating: 3-phase; 10 to 120 Hz, with voltage proportional to frequency throughout voltage range; maximum voltage equals input voltage.
3. Environmental Operating Conditions: 32°F to 104°F, 0 to 3,300 feet above sea level, less than 95% (non-condensing).
4. Minimum Efficiency: 96% at 60 Hz, full load.
5. Overload Capability: 1.1 times the base load current for 60 seconds; minimum of 1.8 times the base load current for three seconds.
6. Starting Torque: Minimum 100% of rated torque from 3 to 60 Hz.

7. Speed Regulation: Plus or minus 5%.
8. Output Carrier Frequency: Selectable; 0.5 to 8 kHz.

H. Inverter Logic: Microprocessor based, isolated from all power circuits.

I. Isolated Control Interface: Allows VFDs to follow remote-control electrical signal over a minimum 40:1 speed range.

J. Internal Adjustability Capabilities:
1. Minimum Speed: 5 to 25 percent of maximum rpm.
2. Maximum Speed: 80 to 100 percent of maximum rpm.

K. Acceleration and Deceleration: 0.1 to 900 seconds.
1. Current Limit: 30 to minimum of 150 percent of maximum rating.

L. Self-Protection and Reliability Features:
1. Input transient protection by means of surge suppressors to provide three-phase protection against damage from supply voltage surges 10 percent or more above nominal line voltage.
2. Loss of Input Signal Protection: Selectable response strategy, including speed default to a percent of the most recent speed, a preset speed, or stop; with alarm.
3. Under- and overvoltage trips.
4. Inverter overcurrent trips.
5. VFD and Motor Overload/Overtemperature Protection: Microprocessor-based thermal protection system for monitoring VFDs and motor thermal characteristics, and for providing VFD overtemperature and motor overload alarm and trip; settings selectable via the keypad; NRTL approved.
6. Critical frequency rejection, with three selectable, adjustable deadbands.
7. Instantaneous line-to-line and line-to-ground overcurrent trips.
8. Loss-of-phase protection.
9. Reverse-phase protection.
10. Short-circuit protection.

M. Automatic Reset/Restart: Attempt three restarts after drive fault or on return of power after an interruption and before shutting down for manual reset or fault correction; adjustable delay time between restart attempts.

N. Bidirectional Autospeed Search: Capable of starting VFD into rotating loads spinning in either direction and returning motor to set speed in proper direction, without causing damage to drive, motor, or load.

O. Torque Boost: Automatically varies starting and continuous torque to at least 1.5 times the minimum torque to ensure high-starting torque and increased torque at slow speeds.

P. Motor Temperature Compensation at Slow Speeds: Adjustable current fall-back based on output frequency for temperature protection of self-cooled, fan-ventilated motors at slow speeds.

Q. Input Line Reactance: Provide a minimum of 5% impedance on the input to the drive. If the standard drive design does not meet the specification of 5%, additional inductors shall be provided to bring the drive up to the specified level.
1. Line reactors: Furnished and installed by the drive manufacturer in the VFD enclosure from the factory. Field installed line reactors shall not be allowed.

R. Harmonic Mitigation:
1. DC bus reactors or Input AC line reactors.
2. Total Harmonic Distortion: Not exceed 10%.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.

C. Check line voltage and phase and ensure agreement with nameplate.

3.02 SHAFT GROUNDING RINGS

A. Shaft grounding rings (SGR) shall be factory installed inside the motors by the manufacturer wherever possible. SGR's may be field installed by installing contractor subject to Engineer's approval. Provide AEGIS SGR Colloidal Silver Shaft Coating, or approved equal, on shafts prior to rings installation, per SGR manufacturer's recommendations, after first cleaning shafts.

B. Install and test SGR's in accordance with manufacturer's recommendations. Install the SGR so that the aluminum frame maintains an even clearance around the shaft. Conductive microfibers shall be in full circumferential contact with conductive metal surface of the shaft. Do not use thread lock to secure the mounting screws as it may compromise the conductive path to ground. If thread lock is required, use a small amount of EP2400 AEGIS Conductive Epoxy, or approved equal, to secure the screws in place.

C. Shafts shall be clean and free of any coatings, paint, or other nonconductive material (clean to bare metal). Depending upon the condition of the shaft, it may require using emery cloth or Scotch-Brite. If the shaft is visibly clean, a non-petroleum based solvent may be used to remove any residue. Check the conductivity of the shaft using an ohm meter. Ohms test: Place the positive and negative meter leads on the shaft at a place where the microfibers will contact the shaft. Each motor will have a different reading but in general one should have a maximum reading of less than 2 ohms. If the reading is higher, clean the shaft again and retest.

D. After motors with SGR are fully installed in the field (in equipment, assemblies, or individually), for both factory-installed-SGR and field-installed-SGR cases, test for a conductive path to ground using an Ohm meter. Place one probe on metal frame of SGR and one probe on motor frame. Motor must be grounded to common earth ground with variable frequency drive according to applicable standards. Verify that SGR installations and test readings comply with SGR manufacturer's requirements.

END OF SECTION

SECTION 21 1300 - FIRE-SUPPRESSION SPRINKLER SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wet-pipe sprinkler system.

B. System design, installation, and certification.

C. Fire department connections.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. NFPA 1963 - Standard for Fire Hose Connections; 2019.

C. UL 405 - Standard for Safety Fire Department Connection Devices; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 210500 Fire Protection General Provisions for submittal procedures.

B. Product Data: Provide data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

C. Shop Drawings:

1. Submit preliminary layout of finished ceiling areas indicating only sprinkler locations coordinated with ceiling installation.
2. Indicate hydraulic calculations, detailed pipe layout, hangers and supports, sprinklers, components, and accessories. Indicate system controls.

D. Designer's qualification statement.

E. Installer's qualification statement.

F. Operation and Maintenance Data: Include components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. Extra Sprinklers: Type and size matching those installed in quantity required by referenced NFPA design and installation standard.
2. Sprinkler Wrenches: For each sprinkler type.

H. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.

1.05 QUALITY ASSURANCE

A. Comply with FM (AG) requirements.

B. Designer Qualifications: Certified NICET Level III, or design system under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

C. Installer Qualifications: Company specializing in performing the work of this section with minimum of 2 years experience in the successful installation and operaion of Fire Protection systems.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store products in shipping containers and maintain in place until installation. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Sprinklers, Valves, and Equipment: Subject to compliance with requirements, provide products by one of the following or other prior approved:
   1. Anvil International: www.anvilintl.com/#sle.
   2. Tyco Fire Protection Products: www.tyco-fire.com/#sle.
   3. Viking Corporation: www.vikinggroupinc.com/#sle.

2.02 SPRINKLER SYSTEM

A. Sprinkler System: Provide coverage for entire building.
B. Occupancy: Determined by Designer.
C. Water Supply: Underground tank.
D. Interface system with building fire and smoke alarm system.
E. Provide fire department connections where indicated.
F. Storage Cabinet for Spare Sprinklers and Tools: Steel, located adjacent to alarm valve.

2.03 SPRINKLERS

A. Finished Ceiling Type:
   1. Flush concealed sprinklers: Rough brass with cover plate of color to match ceiling color.
      a. Coordiante colors with Architect.
B. Exposed Type:
   1. Finished Spaces: Rough bronze pendent or sidewall.
   2. Unfinished Spaces: Rough bronze pendent or sidewall.
C. Flexible Drop System: Stainless steel, multiple use, open gate type.
   1. Application: Use to properly locate sprinkler heads.
   2. Include all supports and bracing.
   3. Provide braided type tube as required for the application.
   4. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
      a. FlexHead Industries, a brand of Anvil International
      b. Easyflex.
      c. Victaulic Company; Vic-Flex
      d. Rascoflex.

2.04 PIPING SPECIALTIES

A. Backflow Preventer: Double check valve assembly backflow preventer with drain and UL/FM approved valves on each end.
   1. Valves: OS&Y gate valve or Butterfly valves.
B. Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two contacts; rated 10 amp at 125 volt AC and 2.5 amp at 24 volt DC.

C. Fire Department Connections:
    1. Type: Flush, wall mount made of corrosion resistant metal complying with UL 405.
        a. Inlets: Two way, 2-1/2 inch swivel fittings, internal threaded. Thread size and inlets according to NFPA 1963 or Authority Having Jurisdiction. Brass caps with gaskets, chains, and lugs.
        b. Configuration: Horizontal.
        c. Finish: Brass or bronze.
        d. Signage: Raised or engraved lettering 1 inch minimum indicating system type.
        e. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
            1) Elkhart Brass Manufacturing Company, Inc; _____: www.elkhartbrass.com/#sle.
            2) Potter Roemer.

D. Valve Supervisory Switches:
    1. Type: Electrically supervised.
    2. Function: Signals that controlled valve is in other than fully open position.

2.05 AUDIBLE VISUAL ALARMS

A. Description: Weatherproof, strobe/horn unit, wall mounted, UL listed.

B. Strobe: Xenon flash, high impact lens.
    1. Effective Candle Power: Minimum 15.0.
    2. Peak Candle Power: 135,000.

C. Horn: 95dBA.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with referenced NFPA design and installation standard.

B. Connect fire-protection standpipe piping to flange provided by mechanical contractor on water-service piping at service entrance into building.

C. Install equipment in accordance with manufacturer's instructions.

D. Provide approved double check valve assembly at sprinkler system water source connection.

E. Locate outside alarm on building wall as indicated.

F. Place pipe runs to minimize obstruction to other work.

G. Place piping in concealed spaces above finished ceilings.

H. Center sprinklers in two directions in ceiling tile and provide piping offsets as required.

I. Apply masking tape or paper cover to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Remove after painting. Replace painted sprinklers.

J. Install air compressor on vibration isolators.

K. Flush entire piping system of foreign matter.

L. Hydrostatically test entire system.

M. Require test be witnessed by Authority Having Jurisdiction.

N. Piping Standard: Comply with requirements in NFPA 14 for installation of fire-protection standpipe piping.

O. Install drain valves on standpipes. Extend drain piping to outside of building.

P. Install automatic (ball drip) drain valves to drain piping between fire-department connections and check valves. Drain to floor drain or outside building.

Q. Install alarm devices in piping systems.

R. Install sleeves for piping penetrations of walls, ceilings, and floors.

S. Install sleeve seals for piping penetrations of exterior concrete walls and slabs.

T. Install escutcheons for piping penetrations of walls, ceilings, and floors.

U. Bushings of any type to obtain reduction in size in fittings are not acceptable.

3.02 VALVE AND SPECIALTIES INSTALLATION

A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

D. Specialty Valves:

1. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.
2. Alarm Valves: Include bypass check valve and retarding chamber drain-line connection.

E. Install audible visual alarm above fire department connection.

3.03 FLEXIBLE SPRINKLER HOSE INSTALLATION

A. Install flexible sprinkler hose connections to heads in all areas with a finished suspended or sheetrock ceiling.

1. Exceptions: Where limited space is a factor and minimum bend radius is not possible. Verify these locations with design engineer and indicate them on the Fire Sprinkler Shop Drawings.

B. Mount heads to bracket system manufactured by same manufacturer as flexible connector drops.

C. Do not over-bend flexible hose. Do not exceed manufacturer recommended minimum radius.

3.04 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 14.

B. Identify system components, wiring, cabling, and terminals.

3.05 FIELD QUALITY CONTROL

A. Fire Sprinkler Service Piping Tests: Test service piping as required by the Authority Having Jurisdiction or, in absence of published procedures, as follows:

1. Witness: Test shall be performed in the presence of the Authority Having Jurisdiction or the representative of the Owner.
2. Testing: Before the joints are covered in order for leaks to be detected.
3. Pressure: Minimum of 200 psig, if maximum static pressure is 150 psig or greater the pressure test shall be 50 psig greater than maximum pressure test.
4. Duration: Two (2) hours.
5. Leakage Rate: Not to exceed two quarts/hr per 100 joints or gaskets irrespective of pipe diameter. Leakage for metal seated valves may increase above leakage rate by one fluid ounce per inch valve diameter per hour for each metal seated valve isolating the test section.

6. Control Valves: Operating test shall be performed on all control valves when system is under full pressure to ensure proper operation.
7. Certification: Upon completion, this Contractor shall complete the “Contractor’s Material & Test Certificate For Underground Piping” contained in NFPA 2 and submit copies to the Owner, Engineer, Local Fire Chief and ISO Commercial Risk Services, Inc.
8. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
9. Flush, test, and inspect sprinkler systems according to NFPA 13, "System Acceptance" Chapter.
10. Flush, test, and inspect standpipe systems according to NFPA 14, "System Acceptance" Chapter.
11. Energize circuits to electrical equipment and devices.
12. Coordinate with fire-alarm tests. Operate as required.
13. Coordinate with fire-pump tests. Operate as required.

B. Verify that equipment hose threads are same as local fire-department equipment.

END OF SECTION

SECTION 21 3000 - FIRE PUMPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Inline fire pump.
B. Vertical turbine fire pump.
C. Electric motor drive.
D. Jockey pump.

1.02 RELATED REQUIREMENTS

A. Design Requirements: Select fire pump to satisfy fire protection system requirements and ANSI/NFPA 20.
B. Section 21 0510 - Common Work Results for Fire Suppression: Fire protection piping.
C. Section 21 0513 - Common Motor Requirements for Fire Suppression Equipment.
D. Section 23 0923 - Direct-Digital Control System for HVAC.
E. Section 23 1113 - Facility Fuel-Oil Piping.
F. Division 26: Electrical characteristics and wiring connections.
G. Divions 28: Fire Detection and Alarm.

1.03 REFERENCE STANDARDS

A. NEMA MG 00001 - Motors and Generators; 2024.
B. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.
C. NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
D. NFPA 20 - Standard for the Installation of Stationary Pumps for Fire Protection; 2022, with Amendment (2021).
E. UL 448 - Centrifugal Stationary Pumps for Fire-Protection Service; Current Edition, Including All Revisions.
F. UL 778 - Standard for Motor-Operated Water Pumps; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 210500 Fire Protection General Provisions, for submittal procedures.
B. Product Data: Provide manufacturers literature including general assembly, pump curves showing performance characteristics with pump and system, operating point indicated, NPSH curve, controls, wiring diagrams, and service connections.
C. Shop Drawings: Indicate layout, general assembly, components, dimensions, weights, clearances, and methods of assembly.
D. Operation Data: Include manufacturers instructions, start-up data, trouble-shooting check lists, for pumps, drivers, and controllers.
E. Maintenance Data: Include manufacturers literature, cleaning procedures, replacement parts lists, and repair data for pumps, drivers and controllers.
F. Project Record Documents: Record actual locations of components and accessories.
G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
    1. See Divions 01, for additional provisions.

1.05 QUALITY ASSURANCE

A. Comply with NFPA 13 and NFPA 20; where requirements differ comply with the most stringent.

B. Installer Qualifications: Company specializing in performing the work of this section with documented experience and approved by the manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver fire pumps and components in factory packing. Comply with manufacturer's rigging and installation instructions.

B. Protect fire pumps and components from physical damage including effects of weather, water, and construction debris.

C. Provide temporary inlet and outlet caps, and maintain in place until installation.

PART 2 PRODUCTS

2.01 FIRE PUMPS

A. Description: Packaged, ULC listed and labeled vertical shaft turbine fire pump and controller.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:

1. Pentair Ltd., Aurora Series.

C. Pump: Materials and construction: to ANSI/NFPA 20.

D. Inline Fire Pump:

1. Manufacturers:
    a. AC Fire Pump, a Xylem brand: www.acfirepump.com/#sle.
    b. Aurora, a Pentair brand: www.pentair.com/#sle.
    c. Fairbanks Nijhuis, a Pentair brand: www.pentair.com/#sle.
    d. SPP Pumps, Inc: www.spppumps.com/#sle.
    e. SyncroFlo, Inc: www.syncroflo.com/#sle.
2. UL 448 and UL 778; vertical- or horizontal-mounted, single-stage, close-coupled centrifugal pump for maximum working pressure of 186 psi.
3. Casing: Cast or ductile iron, or bronze with suction and discharge gauge port, casing wear ring, seal flush connection, drain plug, flanged suction and discharge.
4. Impeller: Bronze, fully enclosed, keyed directly to motor shaft.
5. Shaft: Solid alloy steel with bronze sleeve.

E. Vertical Turbine Fire Pump:

1. Manufacturers:
    a. Armstrong Fluid Technology: www.armstrongfluidtechnology.com/#sle.
    b. Aurora, a Pentair brand: www.pentair.com/#sle.
    c. Fairbanks Nijhuis, a Pentair brand: www.pentair.com/#sle.
    d. Peerless Pump Company: www.peerlesspump.com/#sle.
    e. SPP Pumps, Inc; ____: www.spppumps.com/#sle.
    f. SyncroFlo, Inc: www.syncroflo.com/#sle.
2. UL 448 and UL 778; vertical, multistage centrifugal pump for well water source for maximum working pressure of 510 psi.
3. Casing: Cast iron rated for 1.20 times actual working pressure. Include discharge gauge, air vent, wear rings, seal flush connection, drain plug, and flanged discharge.
4. Impellers: Bronze, fully enclosed, keyed to shaft or secured with lock nut.

5. Shaft: Stainless steel or carbon steel with bronze or stainless steel sleeve through seal chamber.
6. Seals: Packing gland with minimum four rings graphite impregnated packing and bronze lantern rings.

2.02 ELECTRIC MOTOR DRIVE:

A. Motor: Squirrel cage induction type, NEMA MG 00001; in open drip-proof NEMA EN 10250 enclosure, 3,500 rpm; see Section 21 0513.

B. Controller: Limited service type with auto-transformer starter, in NEMA EN 10250 enclosure, including the following:
1. Disconnect Switch: Externally operable, quick break type.
2. Circuit Breaker: Comply with NFPA 20; minimum 65,000 amperes interrupting capacity.
3. Motor Starter: Energized automatically through pressure switch or manually by externally operable handle.
4. Pressure Switch.
5. Running Period Timer: Keeps motor in operation when started automatically, for a minimum of seven minutes.
6. Pilot Lamp: Indicates circuit breaker closed and power available.
7. Test Accessories: Ammeter test link and voltmeter test studs.
8. Alarm Relay: Energizes alarm to indicate circuit breaker open or power failure.
9. Switch Relay: For remote start.
10. Manual Selector Station: On enclosure marked "Automatic" and "Non-Automatic".

2.03 JOCKEY PUMP

A. Manufacturers:
1. Armstrong Fluid Technology: www.armstrongfluidtechnology.com//#sle.
2. Aurora, a Pentair brand; PVM(X) Series: www.pentair.com/#sle.
3. Fairbanks Nijhuis, a Pentair brand; PVM(X) Series: www.pentair.com/#sle.
4. Grundfos: www.us.grundfos.com/#sle.
5. Talco Fire Systems: www.talcofire.com/#sle.

B. Electrically operated, horizontal or vertical, single or multi stage, turbine type centrifugal pump with standard open drip-proof horizontal motor.

C. Control by automatic jockey pump controller with full voltage starter and minimum run timer to start pump on pressure drop in system and stay in operation for minimum period of time. Fire pump shall start automatically on further pressure drop or on jockey pump failure.

2.04 UNDERGROUND WATER TANK WATER LEVEL CONTROL PANEL

A. UL 508A listed with mounting brackets.

B. Thermoplastic.

C. 40VA-24VAC Control Transformer

D. Toggle Open-Closed Auto Switch

E. Heavy Duty 22mm solenoid open, power on indicator

F. 20’ Plastic weighted mechanical float switches, normally closed: Low (open valve), High (close valve).

G. Required screw type terminal blocks/control relays/wire duct.

H. 24 VAC solenoid valve.

I. Coordinate power supply with Electrical Contractor.

2.05 FIBERGLASS UNDERGROUND WATER STORAGE TANK

A. Manway & Access Openings
   1. All water tanks shall require at least one access or manway opening.
   2. All access openings shall be FRP and a minimum of 24" (based on Drawings), complete with gaskets, bolts and covers.
   3. Material
   4. Optional access risers shall be FRP or PVC and provided by the tank manufacturer.
   5. Optional manway extensions shall be FRP and provided by the tank manufacturer.

B. Internal Piping
   1. All internal piping shall be supplied by the tank manufacturer.
   2. Location is shown on submittal drawings.

C. Piping/Fittings
   1. All PVC piping shall be a minimum of SCH 40.
   2. All tanks shall be equipped with factory-installed smooting inlet and overflow piping.
   3. All FRP nozzles shall be flat-faced, flanged (gusseted when needed) and conform to ANSI B16.5 150# bolting pattern.
   4. All threaded fittings shall be constructed of FR, carbon steel or 304 stainless steel.

D. Lifting Lugs
   1. Tank shall have lifting lug(s) that are capable of withstanding weight of tank with a safety factor of at least 2:1.

E. Suction Fill Tubes (as necessary)
   1. Suction/Fill tubes shall be a minimum of PVC SCH 40 or FRP.
   2. Suction/Fill tubes shall be factory installed.
   3. Suction/Fill tubes shall terminate 4 inches above the bottom of tank.
   4. Location shall be as shown on submittal drawings.

F. Anchoring
   1. Anchor straps shall be FRP anchor straps as supplied by tank manufacturer.
   2. Number and location of straps shall be shown on submittal drawings.
   3. Deadmen shall be pre-manufactured and supplied by the tank manufacturer.

G. Optional Ladders
   1. FRP ladders shall be supplied by tank manufacturer.

H. Capacity and Characteristics: as indicated on the Drawings to satisfy fire protection system requirements.

I. Loading Conditions – water tank shall meet the following design criteria:
   1. Internal Load – Tank shall be designed to withstand a 5-psig air pressure test with 5:1 safety factor. Maximum test pressure is 5 psig.
   2. Surface Load – Water tank shall withstand surface H-20 and HS-20 axle loads when properly installed according to manufacturer's current Installation Manual and Operating Guidelines.
   3. External Hydrostatic Pressure an Burial Depth – tank shall be capable of being buried in ground with 10' of overburden over the top of the tank, the hole fully flooded, and maintain a safety factor of 5:1 against general buckling.
   4. Tank shall support accessory equipment – such as access openings, risers, manways and manholes when installed according to tank manufacturers current Installation Manual and Operating Guidelines.

5. Buried tank shall be manufactured with integral trapezoidal ribs for structural integrity.

J. Product Storage
   1. Tank shall be capable of handling liquids with specific gravity up to 1.1.
   2. Tank shall be vented to atmospheric pressure.
   3. Tank shall be capable of handling water for domestic use at ambient temperature.

K. Material

L. Water Tank Dimensions and Capability.
   1. Volume shall be calculated by the Fire Protection Contractor to meet or exceed the NFPA standards for Fire Protection. Volume of tank shall be included in the shop drawing submittals.

PART 3 EXECUTION

3.01 INSTALLATION

A. Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

B. Install in accordance with NFPA 20.

C. Provide access space around pumps for service; no less than minimum as recommended by manufacturer.

D. Piping: 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. For base mounted pumps, provide supports under elbows on pump suction and discharge; see Section 21 0510.

E. Provide drains for bases and seals, piped to and discharging into floor drains.

F. Provide for connection to electrical service; see Division 26.

G. Lubricate pumps before start-up.

H. Provide supervisory alarm notifications using auxiliary dry contacts interconnected into fire alarm system for monitoring by Owner-designated central or off-site point of constant attendance; see Division 28.

I. Provide remote monitoring of pump using either auxiliary dry contacts or software data-link into BAS, BMS, SCADA, or other Integrated Automation System. Remotely monitored points to include:
   1. Run status.
   2. Trouble or fault status.
   3. Phase reversal status.
   4. Supervisory alarm notifications.

3.02 FIELD QUALITY CONTROL

A. See Section 210500 Fire Protection General Provisions for additional requirements.

B. Perform hydrostatic tests, flushing, and field acceptance tests as specified in NFPA 20.

C. Perform field acceptance tests in the presence of Authority Having Jurisdiction.

3.03 CLOSEOUT ACTIVITIES

A. Demonstrate automatic operation of system including verification of pressure switch set points to Owner.

B. Use operation and maintenance data as reference during demonstration.

C. Briefly describe function, operation, and maintenance of each component.

D. Conduct walking tour of project.

E. 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.
3. Instructor: Manufacturer's training personnel.
4. Location: At project site.

3.04 MAINTENANCE

A. See Divions 01 for additional requirements.

B. Provide service and maintenance of equipment installed under this section for one year from the Date of Substantial Completion.

END OF SECTION

SECTION 22 0500 - PLUMBING GENERAL PROVISIONS

PART 1 GENERAL

1.01 SUMMARY

A. Specification Format

1. These Specifications are written in imperative and abbreviated form. This imperative language of the technical sections is directed at the Contractors, unless specifically noted otherwise. Incomplete sentences shall be completed by inserting "shall", "the Contractor shall", and "shall be", and similar mandatory phrases by inference in the same manner as they are applied to notes on the Drawings. The words "shall be" shall be supplied by inference where a colon (:) is used within sentences or phrases. Except as worded to the contrary, perform all indicated requirements whether stated imperatively or otherwise.
2. Three Part Format
    a. "Part 1 - General": Covers those areas which relate to the Work, and which define the general administrative and technical requirements specific to a particular section.
    b. "Part 2 - Products": Defines, in detail, the acceptance equipment and materials to be incorporated into the Work.
    c. "Part 3 - Execution": Describes, in detail, the manner in which items covered by Part 2 are to be incorporated into the Work.
3. Where Codes, Specifications and Drawings are in conflict, the Contractor will be deemed to have bid the more expensive method. Refer all such discrepancies immediately to the Engineer prior to commencing related work.

B. Definitions:

1. Furnish: Supply equipment as required by these Drawings and Specifications, delivered to the job site for installation or use by others.
2. Install: Fix in position for total operational use all apparatus as shown, specified or required. Provide all miscellaneous fittings and wiring supplies.
3. Or Approved Equal: Equipment or materials selected by Contractor subject to Engineer's acceptance.
4. Or Equivalent: Equipment or materials selected by Contractor matching the function and performance of equipment or materials listed.
5. Provide: Furnish and install in place, total and operational.
6. Complete/Completely: All pipes, fittings, wiring supplies, and accessories provided for the noted equipment from the equipment to the mains or noted termination points.

1.02 SCOPE OF WORK

A. The work covered by this Division consists in furnishing all labor, equipment, accessories and materials and in performing all operations necessary for the installation of the plumbing systems, in strict accordance with Division 22 of this Specification and applicable Drawings and subject to the terms and conditions of the Contract.

B. Work of this Division is subject to requirements of Instructions to Bidders, General Conditions, Supplementary Conditions, Division One, and all other sections of this Specification.

C. Examine site and all Contract documents prior to submittal of bid.

1. Submittal of a Bid shall indicate the Contractor has examined the Site and Drawings and has included all required allowances in this Bid. No allowance shall be made for errors resulting from the Contractor's failure to visit job sites and to review Drawings.

D. Division 22 Work: Includes, but is not limited to, providing the following:
   1. Potable Water Distribution System: Fixtures, piping, equipment.
   2. Waste and Vent Systems: Piping and specialties.
   3. Compressed Air Systems: Low pressure (below 150 psi) air piping.

1.03 ALTERNATES

A. Refer to Division 01 for alternates.

B. General
   1. The work of this Section is affected by the Alternates described in Division 1.

1.04 CONTINGENCY

A. Refer to Division 01 for amount to include in Mechanical Bid.

1.05 SUBMITTALS

A. General:
   1. Preferred Submittal Format: PDF, unless otherwise noted.
   2. Preferred Submittal Nomenclature: Unless otherwise noted, PDF submittals are to be named according to the following:
      a. [Specification Section Number] – [Specification Name or Equipment Included]
   3. Distribution: Unless otherwise noted, direct all correspondence concerning Division 22 submittals to:
      a. Derek Olesen
      b. PRAIRIE ENGINEERING, P.C.
      c. 1905 17TH STREET SE
      d. MINOT, ND 58701
      e. dolesen@prairieengineeringpc.com

B. Substitution and Prior Approval to Quote:
   1. Format and Content: Complete descriptive technical data on the proposed item consisting of model numbers, type, size and performance characteristics.
   2. Submission Timing: Minimum of 192 hours (eight days) prior to bid opening.
      a. Substitutions will not be permitted after bid opening except where such substitution is considered by the Engineer to be in the best interest of the Owner.
   3. Bidder Notification: Prior to bid opening via Addenda, sent to all planholders.
   4. Contractor Responsibility: This contractor will be responsible for all coordination, construction costs, and Architectural/Engineering design fees required to substitute equipment that has different characteristics than designed including weights, physical dimensions, clearances, mechanical characteristics, electrical characteristics, and other characteristics deemed important to the design by the Architect/Engineer.
   5. Alternative Format: Printed paper, two copies; Self-addressed, stamped envelope required for return reply.

C. Schedule of Values
   1. Format and Content: When included with the Bid, at minimum the following categories shall be indicated:
      a. “Project mobilization”

b. “Demolition”
c. “Excavation and Backfill”
d. “Insulation”
e. “Domestic Water Piping System” (all piping, valves, shock arrestors, fittings, hangers, installed in place)
f. “Waste and Vent System” (all piping, valves, fittings, hangers, floor drains, interceptors, installed in place)
g. “Storm and Rain System” (all piping, drains, downspouts, fittings, hangers, drain tile, installed in place)
h. “Plumbing Fixtures” (all fixtures, faucets/flush valves, drain assemblies, water coolers, installed in place)
i. “Plumbing Equipment” (all water heaters, recirculation pumps, expansion tanks, storage tanks, installed in place)
j. “Compressed Air System” (all piping, valves, fittings, specialties, installed in place)

2. Submission Timing: Prior to first payment application.

D. Shop Drawings
1. Distribution: Engineer via the Prime Contractor for each item indicated.
2. Format and Content: Include catalog numbers, performance data, dimensions and other descriptive information.
a. Contractor Review: Dated and signed cover sheet or review stamp for each Shop Drawing file to indicate thorough review. Email message text not acceptable.
b. Non-Conforming: Returned to Contractor without review.
3. Submission Timing: Prior to delivery of materials to job site.

E. Record Drawings
1. Format and Content: Paper copy of Drawings project site.
a. As work progresses, Contractor's field supervisor shall mark Record Drawings in red pencil to indicate actual conditions of installation.
b. Give particular attention to marking actual locations of underground piping.
c. Affix all addendum and change order descriptions to appropriate record drawing sheet, utilizing spray adhesive.
d. Make Record Drawings available to Engineer during project visitation.
2. Submission Timing: Close of project with Record Manuals.

F. Spare Equipment and Devices
1. Distribution: Owner.
2. Format and Content: List quantities on contractor letterhead or invoice, obtain signature of Owner's representative acknowledging receipt, and include with each Record Manual.
3. Submission Timing: Close of project with Record Manuals.

G. Operation and Maintenance Manuals
1. Submission Timing: Close of project, as condition of its acceptance.
2. Record Manual information shall be included for all equipment/material where Shop Drawings are required.
3. Format and Content: Two copies, Loose-leaf hardcover binders, and in PDF format on CDs or USB drive.
a. List project name, date, Contractor's name, address and telephone number on exterior label of each Record Manual and CD.

b. Include an index sheet indicating subcontractor and subcontractor's phone number; and each major piece of equipment, supplier and supplier's telephone number. Provide tabbed dividers indicating major groupings of equipment.
c. Include a copy of the Shop Drawings.
d. Include all installation, operation and maintenance data packaged with any equipment.
e. Include all signed and dated final punch lists from walkthroughs performed by the Engineer.

1.06 APPLICATIONS FOR PAYMENT

A. Refer to Division 1 "Applications for Payment".
B. Provide one additional copy, sent directly to the Engineer.
C. Schedule of Values: At minimum, include items in Submittal article.

1.07 CHANGES TO CONTRACT

A. Any required changes to the contract after bid date shall be in accordance with General Conditions/Division 1 and this section. Where any discrepancies between the sections are encountered, the more restrictive section shall apply.
B. Proposed changes shall be accompanied with complete substantiating documentation.
   1. Provide an itemized list of quantities for materials, equipment, and supplies.
      a. Include unit costs for each item and extended price.
      b. Include unit labor for each item and extended time.
   2. Provide subcontractor proposals that include the same substantiating documentation.
   3. Provide quotations from suppliers for any specially ordered equipment.
C. Material costs shall be actual costs to the contractor, obtaining the materials through normal supply channels, including trade and quantity discounts. Utilizing "suggested pricing" from national pricing organizations for unit costs shall not be accepted. Upon request, the contractor or subcontractor shall submit evidence to substantiate the costs.
D. Labor units shall be industry accepted standard labor hours to perform one unit of work. If the work is being performed in a location that is not considered to be standard working conditions for that specific task, additional labor shall be itemized.
E. Labor rates shall be the actual rate paid for the workman category along with associated labor burden. Labor burden shall consist only of the mandatory fringe benefits, labor taxes, and labor insurances as affected by payroll. The owner reserves the right to reject any labor burden which is inconsistent with other similar contractors or where the fringe benefit cost is in excess of established labor agreements.
F. Subcontractors shall compute their costs in the same manner as the contractor. Subcontractors are subject to the same markup constraints as described herein.
G. For changes resulting in credit to the costs, no restocking fees for materials shall be applied by the contractor or subcontractors.

1.08 QUALITY ASSURANCE

A. Qualifications of Installers
   1. For installation and testing, use only trained licensed and experienced workmen familiar with items required and manufacturer's recommended methods.
   2. In acceptance or rejection of installed work, no allowance will be made for lack of skill on the part of the workmen.

1.09 AUTHORITIES AND AGENCIES

A. Materials, workmanship and installation: Comply with the latest editions of all applicable codes, local ordinances, industry standards, utility company regulations, insurance carrier requirements and these Specifications.

B. Obtain and pay all permits, inspections, licenses and other charges pertaining to the Work. Upon completion of the Work, furnish proof of acceptance by proper agency having jurisdiction.

C. Codes and standards shall include, but not necessarily be limited to, the following:
   1. International Energy Conservation Code (IECC);
   2. Uniform Plumbing Code;
   3. North Dakota State Building Code;
   4. International Building Code (IBC);
   5. International Mechanical Code (IMC);
   6. International Fuel Gas Code (IFC);
   7. National Fire Protection Association (NFPA) – Sections as adopted by authority having jurisdiction.

D. The more stringent provisions shall govern where provisions of pertinent codes and standards conflict with these Specifications or Drawings. Where Codes, Specifications or Drawings differ with one another, the Contractor will be deemed to have bid the more expensive method. Refer all such discrepancies to the Engineer immediately.
   1. Pertinent codes and standards shall not be cited to furnish less than specifically shown or specified.
   2. Meeting the minimum standards of the above Codes does not permit a lower grade of construction where Plans or Specifications call for workmanship or materials in excess of Code Requirements.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.10 GUARANTEE AND WARRANTY

A. Except where otherwise noted, contractor shall guarantee materials, workmanship and the proper operation of equipment for a period of one year after Owner's beneficial use of the building or mechanical system. Contractor shall correct all equipment, material and workmanship found to be defective or non-conforming to the contract documents without cost to Owner during that one year period.

B. Guarantee shall include trips to the project site by Contractor to adjust mechanical equipment as required, ensuring it is operating as intended.

C. Specified guarantee shall not relieve Contractor from liability arising from improper installation or non-compliance with applicable codes.

1.11 TEMPORARY FACILITIES

A. Refer to Special Conditions and/or Division 1 for details of temporary facilities.

1.12 NOMENCLATURE

A. Pipe sizes listed are nominal pipe sizes throughout this Division except where otherwise noted.

PART 2 PRODUCTS

2.01 MATERIAL

A. Material and equipment shall be as shown or specified. Provide material not specifically described but required for a complete and proper installation of the Work, subject to the acceptance of the Engineer.

B. Potable-water piping and components shall comply with NSF 14 and NSF 61. Plastic piping components shall be marked with "NSF-pw."

C. Owner will not be liable for material installed in non-compliance with codes, standards, and these Contract Documents.

D. Fire Stop System material shall be by 3M “Fire Barrier”, Metacaulk, Hilti, Nelson Firestop Products, or AD Fire.

E. See Division 07 for further details on approved materials.

2.02 ELECTRIC WIRING

A. The Division 22 Contractor shall furnish all motors, special controls and electrical devices as specified herein for proper operation of the equipment furnished.

B. Division 26 Contractor shall furnish and install, as required, disconnects, starters, switches, etc., and do all necessary power and control wiring including the installation of electrical devices such as thermostats, humidistats, remote control panels, etc., furnished separately by Division 22 Contractor, unless otherwise noted in Equipment Specifications.

PART 3 EXECUTION

3.01 GENERAL

A. Engineer, Architect, or Owner shall not be responsible for the means, methods, techniques, sequences or procedures of construction selected by Contractor.

B. Engineer, Architect, or Owner shall not be responsible for safety precautions and programs incidental to work of Contractor.

C. It is the sole responsibility of Contractor to initiate, maintain, and supervise all safety precautions and programs in connection with the Work.

3.02 SURFACE CONDITIONS

A. Prior to work of each Section of Division 22, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

B. Verify that work of this Division may be installed in accordance with all pertinent codes, regulations and standards.

3.03 PRODUCT HANDLING

A. Protection: Use all means necessary to protect the materials of this Division before, during and after installation and to protect the installed work and materials of all other trades.

B. Plugs: Install in ends of uncompleted piping at end of each day or when work stops.

C. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Engineer and at no additional cost to the Owner.

3.04 COORDINATION

A. Order material in a timely fashion to assure it is on the job site when required.

B. Coordinate installation of material with schedule of other trades to prevent unnecessary delay in construction schedule.

C. Division 22 piping equipment installations shall comply with National Electrical Code requirements 110.26 "working spaces" and "dedicated spaces". Plumbing pipes shall not be installed in the space near electrical panels/equipment de fined as "working spaces" or "dedicated spaces".

3.05 DISCREPANCIES, CONSTRUCTION CONFLICTS AND DRAWINGS

A. Discrepancies
   1. Prior to submitting bid, Contractor shall refer any apparent discrepancies or omissions to Engineer for clarification.
   2. The Architect, Engineer or Owner will not be responsible for any oral instructions or modifications to the contract documents prior to opening of bids.
   3. Written interpretation or clarification will be made by Addenda.

B. Construction Conflicts
   1. Conflicts discovered during construction shall be immediately called to the attention of the Engineer for decision.
   2. Do not proceed with installation in area of question until conflict has been fully resolved.
   3. When so directed by Engineer, Contractor shall make minor adjustment to avoid interferences with other trades. Such minor adjustments shall be performed at no additional cost to the Architect, Engineer or Owner.

C. Drawings
   1. Drawings indicate extent and general layout of plumbing systems for project. Due to small scale, it is not possible to indicate all fittings and accessories that may be required. Provide such fittings and accessories as required to form a complete and operating system in general conformance with Specifications and Drawings.
   2. Exact locations, distances, levels and other conditions will be governed by the structure. Field measurements shall take precedence over the Drawings. Use the Drawings and these Specifications for guidance. Secure the Architect's approval for all changes in locations.
   3. Verify all measurements at site. No compensation will be made because of difference between locations shown on the Drawings and measurements at the building.
   4. Refer to the architectural drawings for dimensions and locations of walls, partitions, doors, windows, ceiling heights, door swings and other details of construction.

3.06 UNDERGROUND UTILITIES

A. Locations of existing underground utilities are based on available site information and are shown approximately. Contractor shall determine exact utility locations before commencing work and shall be responsible for repair of damages resulting from his construction activities to pre-construction condition.

B. Trench and backfill for installation of underground piping to depth shown or required. Remove any accumulated water in excavation by pumping. Shore and brace excavation as required by safety regulations. Provide temporary bridges to maintain normal traffic flow. Excavation and backfill required by mechanical installations shall be accomplished in accordance with Division 31 Specifications by this Contractor.

3.07 OFFSETS

A. Where required to allow clearance of ducts, electrical conduit and outlet boxes, beams, etc., to avoid interference with work of other trades, to increase head room under pipes or to improve the appearance of pipe work, this Contractor shall offset his pipes as directed by the Architect/Engineer.

3.08 CUTTING AND PATCHING

A. Refer to General Conditions. Unless specifically called out to be performed by other Contractors, the Plumbing Contractor shall perform all cutting and patching required for the installation of material and equipment furnished under his Contract.

B. Fire-Barrier Penetrations
   1. Pipe penetrations through fire rated walls and floors shall be sealed with a UL classified Fire Stop System. Fire Stops shall be provided in accordance with the appropriate System No. as it relates to pipe size/Material and wall or floor rating/material.
   2. See Specification Section 220510 for other Fire-Barrier Penetration requirements.
   3. See Section 2 article “Materials” of this Specification for approved fire stop system material.

C. Restore damaged surfaces to their original condition by skilled mechanics of the trade involved. Contractor at fault shall assume all cost.

D. Use only rotary type drilling tools to cut concrete.

E. Do not endanger the stability of the structure. Do not at any time cut or alter work of any other Contractor without Architect's consent.

3.09 FIELD QUALITY CONTROL

A. Perform field tests and inspections. Test new piping and parts of existing piping that have been altered, extended, or repaired.

B. Piping Inspections:
   1. Perform tests specified below in presence of authorities having jurisdiction:
      a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
      b. Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

C. Domestic Water, Sanitary, and Vent Piping Tests: Test domestic water, sanitary, and vent piping as required by the Authority Having Jurisdiction or the Plumbing Code, or, in absence of published procedures, as follows:
   1. Domestic Water Piping:
      a. Pressure: Minimum of 125 psig.
      b. Duration: Two (2) hours.
   2. Sewer, Soil, Waste, Drain and Vent Piping:
      a. Procedure: Close all openings and pressurize with air.
      b. Pressure: Minimum of 5 psig.
      c. Duration: 15 minutes.
      d. System may be tested in its entirety or in sections.
   3. Building sewer from the building to the sewer main:
      a. Insert a test plug at the point of connection with the Public sewer.
      b. Pressure: 10 feet water head.
      c. Duration: 15 minutes, constant water level.

D. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained. Piping will be considered defective if it does not pass tests and inspections.

3.10 ADJUSTING

A. Perform the following domestic water adjustments before operation:

1. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
2. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.11 DISINFECTION OF POTABLE WATER SYSTEM

A. Clean interior of domestic water, septic, and vent piping systems. Remove dirt and debris as work progresses.

B. New potable water systems shall be disinfected prior to use whenever required by the Authority having jurisdiction. The method to be followed shall be that prescribed by the Health Authority or, in case no method is prescribed by the Health Authority, the following: Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.

1. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed follow procedures described below:
    a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    b. Fill and isolate system according to either of the following:
        1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
        2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
    c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
2. The procedure shall be repeated if it is shown by a bacteriological examination, made by the Authority, that contamination still persists in the system.

C. After all tests have been made and the plumbing systems are operating properly, this Contractor shall go over the entire system and remove labels from all plumbing fixtures.

3.12 INSTRUCTIONS

A. Provide written and oral operating and maintenance instructions to Owner's representatives. The oral instructions shall be given before the Owner occupies the buildings. Instructions to include all building's plumbing systems and equipment.

B. Division 22 Contractor shall coordinate with Owner at Owner's convenience, formal instruction time for contractor personnel to instruct Owner's Representatives on all equipment. Provide similar equipment supplier's instructions where specified thus.

C. Formal instructions shall be video recorded when required by other Sections of this Specification by this Contractor. Format shall be DVD. Formal instruction to be included with each Record Manual, being referenced to and a part of the Manual.

3.13 CLEAN UP

A. Each Contractor shall be responsible for cleaning up after his work, including the removal of all scrap material left on the job by his men or Subcontractors. This will include the removal of all pipe cuttings, pieces of pipe and insulation and other debris.

B. After all tests have been made and the plumbing systems are operating properly, this Contractor shall go over the entire system and remove labels from all plumbing fixtures and other plumbing equipment.

C. All equipment having finished paint surfaces shall be examined upon completion for scratches and other damage. Touch up all surfaces as required with paint of color to match factory finish.

END OF SECTION

SECTION 22 0513 - COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General construction and requirements.
B. Applications.
C. Single phase electric motors.
D. Three phase electric motors.
E. Electronically Commutated Motors (ECM).

1.02 RELATED REQUIREMENTS

A. Division 26.

1.03 REFERENCE STANDARDS

A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; 2015 (Reaffirmed 2020).
B. IEEE 112 - IEEE Standard Test Procedure for Polyphase Induction Motors and Generators; 2017.
C. NEMA MG 00001 - Motors and Generators; 2024.
D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

A. See Division 01 for submittal procedures.
B. Product Data: Provide wiring diagrams with electrical characteristics and connection requirements.
C. Manufacturer's Installation Instructions: Indicate setting, mechanical connections, lubrication, and wiring instructions.
D. Operation Data: Include instructions for safe operating procedures.
E. Maintenance Data: Include assembly drawings, bearing data including replacement sizes, and lubrication instructions.

1.05 QUALITY ASSURANCE

A. Comply with NFPA 70.
B. Provide certificate of compliance from Authority Having Jurisdiction indicating approval of high efficiency motors.
C. Products Requiring Electrical Connection: Listed and classified by testing firm acceptable to the Authority Having Jurisdiction as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.

1.07 WARRANTY

A. See Division 01 for additional warranty requirements.

B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace VFDs that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: Two years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following or other prior approved:
   1. Single Phase Motors:
      a. ABB Automation Company.
      b. Reliance.
      c. General Electric.
      d. Marathon.
      e. Century.
   2. Three Phase Motors:
      a. ABB Automation Company.
      b. General Electric.
      c. Marathon.
      d. WEG.
      e. TECO.
      f. NIDEC.
   3. Variable Frequency Drives:
      a. ABB Automation Company.
      b. Cerus Industrial.
      c. Danfoss Inc.; Danfoss Drives Div.
      d. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
      e. General Electric Company.
      f. Rockwell Automation, Inc.; Allen-Bradley Brand.
      g. Square D; a brand of Schneider Electric.
      h. Toshiba International Corporation.

2.02 GENERAL CONSTRUCTION AND REQUIREMENTS

A. Electrical Service:
   1. Motors 3/4 HP and Smaller: 115 volts, single phase, 60 Hz.
   2. Motors Larger than 3/4 Horsepower: 480 volts, three phase, 60 Hz.

B. Nominal Efficiency: Based on motor size as indicated below, and shal comply with ASHRAE 90.1, whichever is greater.
   1. 3/4 HP and Smaller Single Phase: 75.0%.
   2. 1 HP and Smaller Three Phase: 81.5%.
   3. Above 1 HP up to 5 HP: 86.5%.
   4. Above 5 HP: 91.0%

C. Construction:
   1. Open drip-proof type except where specifically noted otherwise.
   2. Design for continuous operation in 105 degrees F environment at altitude of 3500 feet above sea level.

3. Design for temperature rise in accordance with NEMA MG 00001 limits for insulation class, service factor, and motor enclosure type.

D. Explosion-Proof Motors: UL approved and labelled for hazard classification, with over temperature protection.

E. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, efficiency.

F. Wiring Terminations:

1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.
2. For fractional horsepower motors where connection is made directly, provide threaded conduit connection in end frame.

2.03 APPLICATIONS

A. Single phase motors for shaft mounted fans and centrifugal pumps: Split phase type.

B. Single phase motors for shaft mounted fans or blowers: Permanent split capacitor type.

C. Single phase motors for fans, pumps, blowers, and air compressors: Capacitor start type.

D. Single phase motors for fans, blowers, and pumps: Capacitor start, capacitor run type.

E. Motors located in exterior locations, wet air streams downstream of sprayed coil dehumidifiers, draw through cooling towers, air cooled condensers, humidifiers, direct drive axial fans, roll filters, explosion proof environments, and dust collection systems: Totally enclosed type.

F. Motors located in outdoors, in wet air streams downstream of sprayed coil dehumidifiers, in draw through cooling towers, and in humidifiers: Totally enclosed weatherproof epoxy-treated type.

G. Motors located outdoors and in draw through cooling towers: Totally enclosed weatherproof epoxy-sealed type.

2.04 SINGLE PHASE POWER - SPLIT PHASE MOTORS

A. Starting Torque: Less than 150 percent of full load torque.

B. Starting Current: Up to seven times full load current.

C. Breakdown Torque: Approximately 200 percent of full load torque.

D. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve or ball bearings.

E. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

2.05 SINGLE PHASE POWER - PERMANENT-SPLIT CAPACITOR MOTORS

A. Starting Torque: Exceeding one fourth of full load torque.

B. Starting Current: Up to six times full load current.

C. Multiple Speed: Through tapped windings.

D. Open Drip-proof or Enclosed Air Over Enclosure: Class A (50 degrees C temperature rise) insulation, minimum 1.0 Service Factor, prelubricated sleeve or ball bearings, automatic reset overload protector.

2.06 SINGLE PHASE POWER - CAPACITOR START MOTORS

A. Starting Torque: Three times full load torque.

B. Starting Current: Less than five times full load current.

C. Pull-up Torque: Up to 350 percent of full load torque.

D. Breakdown Torque: Approximately 250 percent of full load torque.

E. Motors: Capacitor in series with starting winding; provide capacitor-start/capacitor-run motors with two capacitors in parallel with run capacitor remaining in circuit at operating speeds.

F. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve bearings.

G. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

2.07 THREE PHASE POWER - SQUIRREL CAGE MOTORS

A. Starting Torque: Between 1 and 1-1/2 times full load torque.

B. Starting Current: Six times full load current.

C. Power Output, Locked Rotor Torque, Breakdown or Pull Out Torque: NEMA Design B characteristics.

D. Design, Construction, Testing, and Performance: Comply with NEMA MG 00001 for Design B motors.

E. Insulation System: NEMA Class B or better.

F. Testing Procedure: In accordance with IEEE 112. Load test motors to determine free from electrical or mechanical defects in compliance with performance data.

G. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.

H. Thermistor System (Motor Frame Sizes 254T and Larger): Three PTC thermistors embedded in motor windings and epoxy encapsulated solid state control relay for wiring into motor starter; refer to Section 26 2913.

I. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA STD 9, L-10 life of 20,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.

J. Sound Power Levels: To NEMA MG 00001.

K. Part Winding Start Above 254T Frame Size: Use part of winding to reduce locked rotor starting current to approximately 60 percent of full winding locked rotor current while providing approximately 50 percent of full winding locked rotor torque.

L. Weatherproof Epoxy Sealed Motors: Epoxy seal windings using vacuum and pressure with rotor and starter surfaces protected with epoxy enamel; bearings double shielded with waterproof non-washing grease.

M. Nominal Efficiency: As indicated at full load and rated voltage when tested in accordance with IEEE 112.

N. Nominal Power Factor: As indicated at full load and rated voltage when tested in accordance with IEEE 112.

2.08 THREE-PHASE MOTORS USED WITH VFD

A. Description: Additional requirements for three-phase motors used with variable frequency controllers (VFD).

B. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

C. Motors Used with Variable Frequency Controllers:

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
2. Inverter-Duty Motors: Class F temperature rise; Class H insulation.

2.09 SHAFT GROUNDING RINGS

A. Description: Conductive microfiber shaft grounding ring.
   1. Meet NEMA MG-1 requirements.
   2. Factory installed whenever possible.
B. Basis of Design: AEGIS, model SGR.
C. Type: Minimum of two rows of circumferential fibers on solid ring or split ring.
D. Application Note: Provide on motors greater than 1 HP.
   1. Motors less than 100 HP: Mount ring on either the drive end or non-drive end.
   2. Motors 100 HP and above: Two shaft grounding rings, mounted on the drive end and the non-drive end.

2.10 ELECTRONICALLY COMMUTATED MOTORS (ECM)

A. Description: Brushless DC motor with built in speed and torque controls.
B. Rotor: Permanent magnet.
C. Circuitry: Programmable, manage commutation of stator to be always synchronous with rotor.
D. Multispeed Motors: Minimum turndown of 80%.
E. Efficiency: Minimum of 65%.
F. Bearings: Permanently lubricated, heavy duty ball bearings.
G. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

2.11 VARIABLE FREQUENCY DRIVES

A. Description: Variable-frequency power converter (rectifier, dc bus, and IGBT, PWM inverter).
   1. Units suitable for operation of inverter-duty motors as defined by NEMA MG 1, Section IV, Part 31, "Definite-Purpose Inverter-Fed Polyphase Motors."
B. VFD General Requirements: Comply with NEMA ICS 7, NEMA ICS 61800-2.
   1. Integral Disconnect: Disconnect shall remove all power from unit.
C. Application: Variable torque.
D. Design and Rating: Match load type, such as fans, blowers, and pumps; and type of connection used between motor and load such as direct or through a power-transmission connection.
E. Unit Operating Requirements:
   1. Input AC Voltage Tolerance: Plus 10% and minus 15% of VFD input voltage range rating; +/- 5% of VFD frequency rating.
   2. Output Rating: 3-phase; 10 to 120 Hz, with voltage proportional to frequency throughout voltage range; maximum voltage equals input voltage.
   3. Environmental Operating Conditions: 32°F to 104°F, 0 to 3,300 feet above sea level, less than 95% (non-condensing).
   4. Minimum Efficiency: 96% at 60 Hz, full load.

5. Overload Capability: 1.1 times the base load current for 60 seconds; minimum of 1.8 times the base load current for three seconds.
6. Starting Torque: Minimum 100% of rated torque from 3 to 60 Hz.

F. Speed Regulation: Plus or minus 5%.
1. Output Carrier Frequency: Selectable; 0.5 to 8 kHz.

G. Inverter Logic: Microprocessor based, isolated from all power circuits.

H. Isolated Control Interface: Allows VFDs to follow remote-control electrical signal over a minimum 40:1 speed range.

I. Internal Adjustability Capabilities:
1. Minimum Speed: 5 to 25 percent of maximum rpm.
2. Maximum Speed: 80 to 100 percent of maximum rpm.
3. Acceleration and Deceleration: 0.1 to 900 seconds.
4. Current Limit: 30 to minimum of 150 percent of maximum rating.

J. Self-Protection and Reliability Features:
1. Input transient protection by means of surge suppressors to provide three-phase protection against damage from supply voltage surges 10 percent or more above nominal line voltage.
2. Loss of Input Signal Protection: Selectable response strategy, including speed default to a percent of the most recent speed, a preset speed, or stop; with alarm.
3. Under- and overvoltage trips.
4. Inverter overcurrent trips.
5. VFD and Motor Overload/Overtemperature Protection: Microprocessor-based thermal protection system for monitoring VFDs and motor thermal characteristics, and for providing VFD overtemperature and motor overload alarm and trip; settings selectable via the keypad; NRTL approved.
6. Critical frequency rejection, with three selectable, adjustable deadbands.
7. Instantaneous line-to-line and line-to-ground overcurrent trips.
8. Loss-of-phase protection.
9. Reverse-phase protection.
10. Short-circuit protection.

K. Automatic Reset/Restart: Attempt three restarts after drive fault or on return of power after an interruption and before shutting down for manual reset or fault correction; adjustable delay time between restart attempts.

L. Bidirectional Autospeed Search: Capable of starting VFD into rotating loads spinning in either direction and returning motor to set speed in proper direction, without causing damage to drive, motor, or load.

M. Torque Boost: Automatically varies starting and continuous torque to at least 1.5 times the minimum torque to ensure high-starting torque and increased torque at slow speeds.

N. Motor Temperature Compensation at Slow Speeds: Adjustable current fall-back based on output frequency for temperature protection of self-cooled, fan-ventilated motors at slow speeds.

O. Input Line Reactance: Provide a minimum of 5% impedance on the input to the drive. If the standard drive design does not meet the specification of 5%, additional inductors shall be provided to bring the drive up to the specified level.
1. Line reactors: Furnished and installed by the drive manufacturer in the VFD enclosure from the factory. Field installed line reactors shall not be allowed.

P. Harmonic Mitigation:

1. DC bus reactors or Input AC line reactors.
2. Total Harmonic Distortion: Not exceed 10%.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.

C. Check line voltage and phase and ensure agreement with nameplate.

3.02 SHAFT GROUNDING RINGS

A. Shaft grounding rings (SGR) shall be factory installed inside the motors by the manufacturer wherever possible. SGR's may be field installed by installing contractor subject to Engineer's approval. Provide AEGIS SGR Colloidal Silver Shaft Coating, or approved equal, on shafts prior to rings installation, per SGR manufacturer's recommendations, after first cleaning shafts.

B. Install and test SGR's in accordance with manufacturer's recommendations. Install the SGR so that the aluminum frame maintains an even clearance around the shaft. Conductive microfibers shall be in full circumferential contact with conductive metal surface of the shaft. Do not use thread lock to secure the mounting screws as it may compromise the conductive path to ground. If thread lock is required, use a small amount of EP2400 AEGIS Conductive Epoxy, or approved equal, to secure the screws in place.

C. Shafts shall be clean and free of any coatings, paint, or other nonconductive material (clean to bare metal). Depending upon the condition of the shaft, it may require using emery cloth or Scotch-Brite. If the shaft is visibly clean, a non-petroleum based solvent may be used to remove any residue. Check the conductivity of the shaft using an ohm meter. Ohms test: Place the positive and negative meter leads on the shaft at a place where the microfibers will contact the shaft. Each motor will have a different reading but in general one should have a maximum reading of less than 2 ohms. If the reading is higher, clean the shaft again and retest.

D. After motors with SGR are fully installed in the field (in equipment, assemblies, or individually), for both factory-installed-SGR and field-installed-SGR cases, test for a conductive path to ground using an Ohm meter. Place one probe on metal frame of SGR and one probe on motor frame. Motor must be grounded to common earth ground with variable frequency drive according to applicable standards. Verify that SGR installations and test readings comply with SGR manufacturer's requirements.

END OF SECTION

SECTION 22 0553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Pipe markers.

1.02 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2023.

1.03 SUBMITTALS

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

B. Product Data: Provide manufacturers catalog literature for each product required.

PART 2 PRODUCTS

2.01 PLUMBING COMPONENT IDENTIFICATION GUIDELINE

A. Nameplates:

1. Heat exchangers, water heaters, and other heat transfer products.
2. Control panels, transducers, and other related control equipment products.
3. Pumps, tanks, filters, water treatment devices, and other plumbing equipment products.

B. Tags:

1. Manual operated and automated control valves.

C. Pipe Markers: 3/4 inch diameter and higher.

2.02 NAMEPLATES

A. Description: Laminated piece with up to three lines of text.

1. Letter Color: White.
2. Letter Height: 1/4 inch.

2.03 TAGS

A. Flexible: Vinyl with engraved black letters on light contrasting background color with up to three lines of text. Minimum tag size 1-1/2 inch in diameter.

B. Metal: Brass, 19 gauge 1-1/2 inch in diameter with smooth edges, blank, smooth edges, and corrosion-resistant ball chain. Up to three lines of text.

2.04 PIPE MARKERS

A. Flexible Marker: Factory fabricated, semi-rigid, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid conveyed.

B. Flexible Tape Marker: Flexible, vinyl film tape with pressure-sensitive adhesive backing and printed markings.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install flexible nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install plastic pipe markers in accordance with manufacturer's instructions.

C. Apply ASME A13.1 Pipe Marking Rules:

1. Place pipe marker adjacent to changes in direction.
2. Place pipe marker adjacent each valve port and flange end.
3. Place pipe marker at both sides of floor and wall penetrations.
4. Place pipe marker every 25 to 50 feet interval of straight run.

END OF SECTION

SECTION 22 0719 - PLUMBING PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Combustible pipe insulation.
B. Expanded polystyrene insulation.
C. Flexible elastomeric cellular insulation.
D. Glass fiber insulation.
E. Polyethylene insulation.
F. Jacketing and accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

1.03 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 C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2023.
C. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2022a.
D. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2023.
E. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2023).
F. ASTM C1423 - Standard Guide for Selecting Jacketing Materials for Thermal Insulation; 2021.
G. ASTM D1056 - Standard Specification for Flexible Cellular Materials—Sponge or Expanded Rubber; 2020.
H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
I. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.
J. SAE AMS3779 - Tape, Adhesive, Pressure-Sensitive Thermal Radiation Resistant, Aluminum Coated Glass Cloth; 2016b.
K. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

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 INSULATION

A. Manufacturers:
   1. CertainTeed Corporation: www.certainteed.com/#sle.
   2. Johns Manville Corporation: www.jm.com/#sle.
   3. Knauf Insulation: www.knaufinsulation.com/#sle.
   4. Owens Corning Corporation: www.ocbuildingspec.com/#sle.
   5. Substitutions: See Section 23 0500 - HVAC General Provisions.

B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
   1. K Value: ASTM C177, 0.24 at 75 degrees F.
   2. Maximum Service Temperature: 850 degrees F.
   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.

D. Vapor Barrier Lap Adhesive: Compatible with insulation.

2.03 COMBUSTIBLE PIPE INSULATION

A. Manufacturers:
   1. Johns Manville Corporation: www.jm.com/#sle.
   2. Substitutions: See Section 23 0500 - HVAC General Provisions.

B. Insulation: ASTM C547; rigid, molded, noncombustible.
   1. Rated to a maximum 25/50 FS/SD per ASTM E84, CAN ULC S102.

2.04 EXPANDED POLYSTYRENE INSULATION

A. Insulation: ASTM C578; rigid closed cell.
   1. K Value: 0.23 at 75 degrees F.
   2. Maximum Service Temperature: 165 degrees F.
   3. Maximum Water Vapor Permeance: 5.0 perm inch.

2.05 POLYETHYLENE INSULATION

A. Manufacturers:
   1. Armacell LLC: www.armacell.us/#sle.
   2. Substitutions: See Section 23 0500 - HVAC General Provisions.

B. Insulation: Flexible closed-cell polyethylene tubing, slit lengthwise for installation, complying with applicable requirements of ASTM D1056.
   1. K Value: ASTM C177; 0.25 at 75 degrees F.
   2. Maximum Service Temperature: 200 degrees F.
   3. Density: 2 pcf.
   4. Maximum Moisture Absorption: 1.0 percent by volume.
   5. Moisture Vapor Permeability: 0.05 perm inch, when tested in accordance with ASTM E96/E96M.
   6. Connection: Contact adhesive.

2.06 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturers:
   1. Aeroflex USA: www.aeroflexusa.com/#sle.
   2. Armacell LLC: www.armacell.us/#sle.
   3. K-Flex USA LLC: www.kflexusa.com/#sle.

4. Substitutions: See Section 23 0500 - HVAC General Provisions.

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.
   2. Maximum Service Temperature: 220 degrees F.
   3. Connection: Waterproof vapor barrier adhesive.

2.07 JACKETING AND ACCESSORIES

A. PVC Plastic Jacket:
   1. Manufacturers:
      a. Johns Manville Corporation: www.jm.com/#sle.
      b. Substitutions: See Section 23 0500 - HVAC General Provisions.
   2. Jacket: One piece molded type fitting covers and sheet material, off-white color.
      a. Minimum Service Temperature: 0 degrees F.
      b. Maximum Service Temperature: 150 degrees F.
      c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
      d. Thickness: 10 mil, 0.010 inch.
      e. Connections: Brush on welding adhesive.

B. ABS Plastic Jacket:
   1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
      a. Minimum Service Temperature: Minus 40 degrees F.
      b. Maximum Service Temperature: 180 degrees F.
      c. Moisture Vapor Permeability: 0.012 perm inch, when tested in accordance with ASTM E96/E96M.
      d. Thickness: 30 mil, 0.03 inch.
      e. Connections: Brush on welding adhesive.

C. Canvas Jacket: UL listed 6 oz/sq yd plain weave cotton fabric treated with dilute fire-retardant lagging adhesive.

D. Reinforced Tape:
   1. FSK tape suitable for sealing seams between insulation, insulated pipe bends, and fittings resulting in a tight, smooth surface without wrinkles.
   2. Comply with UL 723 or ASTM E84.
   3. Moisture Vapor Permeability: 0.00 perm inch, when tested in accordance with ASTM E96/E96M.

PART 3 EXECUTION

3.01 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 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 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, 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. Inserts and Shields:
   1. Application: Piping 1-1/2 inches 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 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.

I. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, see Section 07 8400
   1. At fire separations, terminate insulation at fire-rated wall and partition penetrations.

J. Fire-Barrier Penetration Protection:
   1. Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials.
   2. Provide intumescent collars, wraps, fire bands, sealants, and other firestopping materials as required to maintain the fire ratings for the piping and insulation materials used.
   3. Install Fire Stop Systems per the manufacturers guidelines.

K. Buried Piping: Provide factory fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt impregnated open mesh glass fabric, with one mil, 0.001 inch thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with a polyester film.

3.02 SCHEDULES

A. Domestic Hot Water Supply, Above 140 degree F:
   1. Glass Fiber Insulation: Aboveground.
   2. Elastomeric Celular Insulation: Aboveground and belowground.
   3. 1-1/4” diameter pipe and smaller: 1-1/2” thick, R-6 minimum.
   4. 1-1/2” diameter pipe and larger: 2” thick, R-8 minimum.

B. Domestic Hot Water Supply and Recirculating Water, 140 degree F and below:
   1. Glass Fiber Insulation: Aboveground.
   2. Elastomeric Celular Insulation: Aboveground and belowground.
   3. 1-1/4” diameter pipe and smaller: 1” thick, R-4 minimum.
   4. 1-1/2” diameter pipe and larger: 1-1/2” thick, R-6 minimum.
   5. Domestic Cold Water:

a. Glass Fiber Insulation: Aboveground.
b. Elastomeric Celular Insulation: Aboveground and belowground.
c. 1-1/4” diameter pipe and smaller: 1” thick, R-4 minimum.
d. 1-1/2” diameter pipe and larger: 1-1/2” thick, R-6 minimum.

6. Roof Drain Bodies:
   a. 1" premolded or job-fabricated glass fiber insulation. Over insulation, apply 6 ounce canvas neatly pasted in place and apply two coats of sealant over the entire surface.
7. Roof Drainage Above Grade:
   a. Metal Piping: Glass fiber insulation, 1" thick.
8. Roof Drainage Within 10 Feet of the Exterior:
   a. Fiberglass insulation, 1" thick, R-4 minimum.
9. Plastic Piping, ceilling plenum spaces:
   a. Combustible pipe insulation.

END OF SECTION

SECTION 22 1005 - PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sanitary waste piping, buried within 5 feet of building.
B. Sanitary waste piping, above grade.
C. Domestic water piping, buried within 5 feet of building.
D. Domestic water piping, above grade.
E. Storm drainage piping, buried within 5 feet of building.
F. Storm drainage piping, above grade.
G. Pipe flanges, unions, and couplings.
H. Pipe hangers and supports.
I. Pipe sleeve-seal systems.
J. Ball valves.
K. Butterfly valves.
L. Balancing valves.

1.02 RELATED REQUIREMENTS

A. Section 22 0516 - Expansion Fittings and Loops for Plumbing Piping.
B. Section 22 0719 - Plumbing Piping Insulation.

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 B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings: DWV; 2021.
D. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder-Joint Drainage Fittings—DWV; 2022.
E. ASME B16.51 - Copper and Copper Alloy Press-Connect Pressure Fittings; 2021.
F. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2022).
G. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings; 2021.
H. ASTM B32 - Standard Specification for Solder Metal; 2020.
I. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.
J. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2020.
K. ASTM B306 - Standard Specification for Copper Drainage Tube (DWV); 2020.
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 C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2020a.
O. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings; 2022.
P. ASTM D2239 - Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter; 2022.

Q. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems; 2020 (Reapproved 2024).

R. ASTM D2609 - Standard Specification for Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe; 2024.

S. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2024.

T. ASTM D2680 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Piping; 2020.

U. ASTM D2846/D2846M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems; 2024.

V. 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).

W. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2024, with Editorial Revision (2025).

X. ASTM F437 - Standard Specification for Threaded Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80; 2024.

Y. ASTM F438 - Standard Specification for Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40; 2023.

Z. ASTM F439 - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80; 2024.

AA. ASTM F441/F441M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80; 2023.

BB. ASTM F442/F442M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR); 2023.

CC. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings; 2022.

DD. AWWA C606 - Grooved and Shouldered Joints; 2022.

EE. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2021.

FF. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2020.

GG. IAPMO (UPC) - Uniform Plumbing Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

HH. IAPMO/ANSI/CAN Z1117 - Standard for Press Connections; 2022.

II. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).

JJ. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010, with Errata .

KK. NSF 61 - Drinking Water System Components - Health Effects; 2024.

LL. NSF 372 - Drinking Water System Components - Lead Content; 2024.

1.04 SUBMITTALS

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

B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

C. Project Record Documents: Record actual locations of valves.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. 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 wet or 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 WASTE PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. CPVC Pipe: ASTM D2846/D2846M, ASTM F441/F441M, or ASTM F442/F442M.
   1. Fittings: CPVC; ASTM D2846/D2846M, ASTM F437, ASTM F438, or ASTM F439.
   2. Joints: ASTM D2846/D2846M, solvent weld with ASTM F493 solvent cement.

B. PVC Pipe: ASTM D2665 or ASTM D3034.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.03 SANITARY WASTE PIPING, ABOVE GRADE

A. Cast Iron Pipe: ASTM A74, service weight.
   1. Fittings: Cast iron.
   2. Joint Seals: ASTM C564 neoprene gaskets, or lead and oakum.

B. Cast Iron Pipe: CISPI 301, hubless, service weight.
   1. Fittings: Cast iron.
   2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.

C. Copper Tube: ASTM B306, DWV.
   1. Fittings: ASME B16.29, wrought copper, or ASME B16.23, sovent.
   2. Joints: ASTM B32, alloy Sn50 solder.

D. 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 OF BUILDING

A. Copper Pipe: ASTM B88 (ASTM B88M), Type K (A), 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.

B. 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 Pipe: ASTM B88 (ASTM B88M), Type L or K, 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: ASME B16.51 or IAPMO/ANSI/CAN Z1117, ICC (IPC), and IAPMO (UPC) approved, NSF 61 and NSF 372 certified, with EPDM seals.
      a. Manufacturers:
         1) Anvil International: www.anvilintl.com/#sle.
         2) Apollo Valves: www.apollovalves.com/#sle.
         3) NIBCO, Inc.

2.06 STORM DRAINAGE PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. PVC Pipe: ASTM D2665 or ASTM D3034.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.07 STORM DRAINAGE PIPING, ABOVE GRADE

A. Cast Iron Pipe: ASTM A74 service weight.
B. ABS Pipe: ASTM D2680.
   1. Fittings: ABS.
   2. Joints: Solvent welded with ASTM D2235 cement.
C. PVC Pipe: ASTM D2665.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.08 PIPE FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 inch and Under:
   1. Copper Tube and Pipe: Class 150 bronze unions with soldered joints.
B. Mechanical Couplings for Grooved and Shouldered Joints: Two or more curved housing segments with continuous key to engage pipe groove, circular C-profile gasket, and bolts to secure and compress gasket.
   1. Dimensions and Testing: In accordance with AWWA C606.
   2. Housing Material: Provide ASTM A47/A47M malleable iron, ductile iron, or _____, galvanized.
   3. Bolts and Nuts: Hot dipped galvanized or zinc-electroplated steel.
   4. When pipe is field grooved, provide coupling manufacturer's grooving tools.

2.09 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.
B. Plumbing Piping - Drain, Waste, and Vent:

1. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.
2. Hangers for Pipe Sizes 2 inch and Over: Carbon steel, adjustable, clevis.
3. Wall Support for Pipe Sizes to 3 inch: Cast iron hook.
4. Wall Support for Pipe Sizes 4 inch and Over: Welded steel bracket and wrought steel clamp.
5. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

C. Plumbing Piping - Water:

1. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.
2. Hangers for Cold Pipe Sizes 2 inch and Over: Carbon steel, adjustable, clevis.
3. Hangers for Hot Pipe Sizes 2 to 4 inch: Carbon steel, adjustable, clevis.
4. Wall Support for Pipe Sizes Up to 3 inch: Cast iron hook.
5. Wall Support for Pipe Sizes 4 inch and Larger: Welded steel bracket and wrought steel clamp.

2.10 PIPE SLEEVE-SEAL SYSTEMS

A. Manufacturers:

1. GPT, a company of Enpro Industries, Inc: www.gptindustries.com/#sle.
2. The Metraflex Company: www.metraflex.com/#sle.
3. Substitutions: See Section 22 0500 - Plumbing General Provisions.

B. Modular Mechanical Seals:

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 to service requirements.
4. Glass reinforced plastic pressure end plates.

2.11 BALL VALVES

A. Manufacturers:

1. Anvil International: www.anvilintl.com/#sle.
2. Apollo Valves: www.apollovalves.com/#sle.

B. Construction, 4 inch and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze or ductile iron body, 304 stainless steel or chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, threaded or grooved ends with union.

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 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

C. Install piping to maintain headroom, conserve space, and not interfere with use of space.

D. Group piping whenever practical at common elevations.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. See Section 22 0516.

F. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

G. Provide access where valves and fittings are not exposed.

H. 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.

I. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.

J. Sleeve pipes passing through partitions, walls, and floors.

K. Pipe Hangers and Supports:

1. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
2. Place hangers within 12 inches of each horizontal elbow.
3. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
4. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
6. Provide copper plated hangers and supports for copper piping.

L. Pipe 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 watertight seal.
6. Install in accordance with manufacturer's recommendations.

3.04 APPLICATION

A. Use grooved mechanical couplings and fasteners only in accessible locations.

B. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

C. Provide flow controls in water recirculating systems where indicated.

3.05 FIELD TESTS AND INSPECTIONS

A. Verify and inspect systems according to requirements by the Authority Having Jurisdiction. In the absence of specific test and inspection procedures proceed as indicated below.

B. Domestic Water Systems:

1. Perform hydrostatic testing for leakage prior to system disinfection.
2. Test Preparation: Close each fixture valve or disconnect and cap each connected fixture.
3. General:
    a. Fill the system with water and raise static head to 10 psi above service pressure. Minimum static head of 50 to 150 psi. As an exception, certain codes allow a maximum static pressure of 80 psi.

C. Test Results: Document and certify successful results, otherwise repair, document, and retest.

3.06 SCHEDULES

A. Pipe Hanger Spacing:

1. Metal Piping:
    a. Pipe Size: 1/2 inch to 1-1/4 inch:
        1) Maximum Hanger Spacing: 6.5 ft.
        2) Hanger Rod Diameter: 3/8 inches.
    b. Pipe Size: 1-1/2 inch to 2 inch:
        1) Maximum Hanger Spacing: 10 ft.
        2) Hanger Rod Diameter: 3/8 inch.
    c. Pipe Size: 2-1/2 inch to 3 inch:
        1) Maximum Hanger Spacing: 10 ft.
        2) Hanger Rod Diameter: 1/2 inch.
    d. Pipe Size: 4 inch to 6 inch:
        1) Maximum Hanger Spacing: 10 ft.
        2) Hanger Rod Diameter: 5/8 inch.
    e. Pipe Size: 8 inch to 12 inch:
        1) Maximum hanger spacing: 14 ft.
        2) Hanger Rod Diameter: 7/8 inch.
    f. Pipe Size: 14 inch and Over:
        1) Maximum Hanger Spacing: 20 ft.
        2) Hanger Rod Diameter: 1 inch.
2. Plastic Piping:
    a. All Sizes:
        1) Maximum Hanger Spacing: 6 ft.
        2) Hanger Rod Diameter: 3/8 inch.

END OF SECTION

SECTION 22 1006 - PLUMBING PIPING SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Drains.
B. Cleanouts.
C. Hose bibbs.
D. Hydrants.
E. Washing machine outlet boxes.
F. Ice maker outlet boxes.
G. Backwater valves.
H. Plug valves.
I. Backflow preventers.
J. Double check valve assemblies.
K. Water hammer arrestors.
L. Sanitary waste interceptors.
M. Drain tempering valve.
N. Washer drain trough.
O. Mixing valves.
P. Relief valves.
Q. Floor drain trap seals.
R. Electronic trap-seal primer assembly.
S. Electronic trap-seal primer.
T. Pipe heating cables.

1.02 RELATED REQUIREMENTS

A. Section 22 1005 - Plumbing Piping.
B. Section 22 3000 - Plumbing Equipment.
C. Section 22 4000 - 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 1012 - Performance Requirements for Backflow Preventers with an Intermediate Atmospheric Vent; 2021.
E. ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Prevention Assemblies; 2021.
F. ASSE 1015 - Performance Requirements for Double Check Backflow Prevention Assemblies; 2021.
G. ASSE 1019 - Performance Requirements for Wall Hydrant with Backflow Protection and Freeze Resistance; 2023.
H. NSF 61 - Drinking Water System Components - Health Effects; 2024.
I. NSF 372 - Drinking Water System Components - Lead Content; 2024.

J. PDI-WH 201 - Water Hammer Arresters; 2017.

1.04 SUBMITTALS

A. See Section 22 0500 - Plumbing General Provisions 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. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

F. Project Record Documents: Record actual locations of equipment, cleanouts, backflow preventers, and water hammer arrestors.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. Extra Loose Keys for Outside Hose Bibbs: One.
2. Extra Hose End Vacuum Breakers for Hose Bibbs: One.

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. Josam Company: www.josam.com/#sle.
2. MIFAB, Inc: www.mifab.com/#sle.
3. Sioux Chief Manufacturing.
4. Watts Drainage Products.
5. Zurn Industries, LLC: www.zurn.com/#sle.
6. Substitutions: See Section 22 0500 - Plumbing General Provisions.

B. Roof Drains:

1. Assembly: ASME A112.6.4.
2. Body: Lacquered cast iron with sump.
3. Strainer: Removable cast metal dome.
4. Accessories: Coordinate with roofing type:
    a. Membrane flange and membrane clamp with integral gravel stop.
    b. Adjustable under deck clamp.
    c. Roof sump receiver.

C. Roof Overflow Drains:

1. Lacquered cast iron body and clamp collar and bottom clamp ring; pipe extended to 2 inches above flood elevation.

D. Downspout Nozzles, Metal:

1. Basis of Design: Zurn model Z199.
2. Description: Cast bronze or nickel bronze wall-mounted fitting for terminating interior rainwater leader on building exterior, with anchor flange and decorative cow's tongue outlet.

E. Floor Drains:

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. Pre-packaged shims for tilt correction.
3. Above Grade Drain Bodies: Provide flashing materials of 8" minimum wider in all directions from drain body.
    a. Exception: Shower drains where flashing materials are furnished and installed by the General Contractor.

F. Prefabricated Trench Drain: Trench drain system assembled from factory fabricated, polymer concrete castings in standard lengths and variable depths, with integral joint flanges and integral grating support rails; includes joint gaskets and grating.
1. Grate for Shop Application: Slotted ductile iron, epoxy or powder coated; Load Class C, 176-325 psi, heavy duty.
2. Grate for Kitchen Application: Slotted stainless steel; Load Class A, 0-60 psi, light duty.
3. Grate for Shower Application: Slotted, heel-proof, stainless steel; Load Class A, 0-60 psi, light duty.

G. Floor Sink:
1. Round lacquered cast iron body with integral seepage pan, epoxy coated interior, aluminum dome strainer, nickel bronze frame, full grate and half grate.

H. Pool Deck Floor Trench:
1. Manufacturers:
    a. Mini Channel Drains, NDS Inc.
    b. Substitutions: See Section 22 0500 - Plumbing General Provisions.
2. Construction:
    a. Body Material: Honeycomb reinforced PVC with UV inhibitor.
    b. Flange: Bottom flange integral to body with stainless steel stakes.
    c. Grate Material: ADA Compliant; heel-proof; solid brass with satin finish; Load Class A, 0-60 psi, light duty.

2.03 CLEANOUTS

A. Manufacturers:
1. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.
2. Josam Company: www.josam.com/#sle.
3. MIFAB, Inc: www.mifab.com/#sle.
4. Sioux Chief Manufacturing Company, Inc.
5. Watts Drainage Products.
6. Zurn Industries, LLC: www.zurn.com/#sle.
7. Substitutions: See Section 22 0500 - Plumbing General Provisions.

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. Soil pipe test tee body, match material to connected piping.
2. Raised head, threaded plug.
3. Round stainless steel access cover secured with machine screw.

F. Cleanouts at Interior Unfinished Accessible Areas (CO-5): Calked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.

2.04 HOSE BIBBS

A. Manufacturers:
1. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.
2. Watts Regulator Company: www.wattsregulator.com/#sle.
3. Zurn Industries, LLC: www.zurn.com/#sle.
4. Substitutions: See Section 22 0500 - Plumbing General Provisions.

B. Interior Hose Bibbs:
1. Bronze or brass with integral mounting flange, replaceable hexagonal disc, hose thread spout, chrome-plated where exposed with handwheel, nonremovable vacuum breaker in compliance with ASSE 1011.

C. Interior Mixing Type Hose Bibbs:
1. Bronze or brass, hot- and cold- water wall-faucet with mounting flange, replaceable seats, hose thread spout, integral checks, handwheels, and vacuum breaker complying with ASSE 1011.

2.05 HYDRANTS

A. Manufacturers:
1. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.
2. WADE: www.wadedrains.com/#sle.
3. Zurn Industries, LLC: www.zurn.com/#sle.
4. Substitutions: .See Section 22 0500 - Plumbing General Provisions.

B. Wall Hydrants:
1. ASSE 1019; freeze resistant, self-draining type with finish as scheduled, hose thread spout, and integral vacuum breaker.
a. Operation: As scheduled. For loose key, provide one key with each hydrant.

2.06 WASHING MACHINE OUTLET BOXES

A. Manufacturers:
1. IPS Corporation/Water-Tite; _____: www.ipscorp.com/#sle.
2. Oatey Supply Chain Services, Inc; _____: www.oatey.com/#sle.
3. Precision Plumbing Products.
4. Sioux Chief Manufacturing Company, Inc.
5. Zurn Industries, LLC; _____: www.zurn.com/#sle.
6. Substitutions: See Section 22 0500 - Plumbing General Provisions.

B. Description: Plastic preformed rough-in box with brass valves with single lever handle, socket for 2 inch waste, slip in finishing cover.

2.07 ICE MAKER OUTLET BOXES

A. Manufacturers:
1. IPS Corporation/Water-Tite; _____: www.ipscorp.com/#sle.
2. Oatey Supply Chain Services, Inc; _____: www.oatey.com/#sle.
3. Zurn Industries, LLC; _____: www.zurn.com/#sle.

4. Precision Plumbing Products.
5. Sioux Chief Manufacturing Company, Inc.
6. Substitutions: See Section 22 0500 - Plumbing General Provisions.

B. Description: Plastic preformed square or round rough-in box with brass quarter-turn ball valve, and slip-in finishing cover.

2.08 BACKWATER VALVES

A. Manufacturers:
1. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.
2. MIFAB, Inc.
3. Sioux Chief Manufacturing Company, Inc.
4. Tyler Pipe; Wade Div.
5. Watts Drainage Products Inc.
6. Zurn Industries, LLC: www.zurn.com/#sle.
7. Substitutions: See Section 22 0500 - Plumbing General Provisions.

B. Cast Iron Backwater Valves: ASME A112.6.4; lacquered cast iron body and cover, brass valve, extension sleeve, and access cover.

C. Plastic Backwater Valves: ABS body and valve, extension sleeve, and access cover.

2.09 PLUG VALVES

A. Description: Non-lubricated, quarter turn, full port, eccetric-type underground waste pipe valve.

B. Manufacturers:
1. Henry Pratt Company.
2. Milliken Valve Company.
3. Val-Matic Valve & Manufacturing Corporation.
4. Substitutions: See Section 22 0500 - Plumbing General Provisions.

C. Construction:
1. Body: ASTM A126 Class B cast iron.
2. Seat: Minimum 90% nickel, welded in overlay.
3. Plug: ASTM A536 ductile iron, Buna N or Nitrile seating surface.
4. Bearings: Permanently lubricated 316 stainless steel.
5. Actuator: Direct nut; grease packed, stops in open/close position; 2” nut.

D. Accessories: T-handle to operate valve.

2.10 BACKFLOW PREVENTERS

A. Manufacturers:
1. Apollo Valves: www.apollovalves.com/#sle.
2. MIFAB, Inc; BEECO Backflow Preventers: www.mifab.com/#sle.
3. Watts Regulator Company, a part of Watts Water Technologies: www.wattsregulator.com/#sle.
4. Zurn Industries, LLC: www.zurn.com/#sle.
5. Substitutions: See Section 22 0500 - Plumbing General Provisions.

B. Reduced Pressure Backflow Preventer Assembly:
1. ASSE 1013 and NSF 61 compliant reinforced-nylon body 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, integral male test fittings, and non-threaded vent outlet.

2. Size: 3/4 to 2 inch assembly with threaded full port ball valves.
3. Accessories: Provide air gap fitting, lead-free Y-strainer, and test cocks.

C. Reduced Pressure Backflow Preventer Assembly:

1. ASSE 1013 and NSF 61 compliant stainless steel body assembly with corrosion resistant internal parts, stainless steel springs, diaphragm type differential pressure relief valve located between check valves, third check valve that opens under back pressure in case of diaphragm failure, and non-threaded vent outlet.
2. Configured to protect against backsiphonage and backpressure into potable water supply.
3. Size: 2-1/2 to 10 inch assembly with flanged OS&Y gate valves.
4. Accessories: Provide flanged Y-strainer, pressure monitor, and test cock.

2.11 DOUBLE CHECK-VALVE ASSEMBLIES

A. Manufacturers:

1. Apollo Valves: www.apollovalves.com/#sle.
2. Watts Regulator Company, a part of Watts Water Technologies: www.wattsregulator.com/#sle.
3. Zurn Industries, LLC; 350AST: www.zurn.com/#sle.
4. Substitutions: See Section 22 0500 - Plumbing General Provisions.

B. Double Check Valve Assembly:

1. ASSE 1012; cast bronze body with corrosion resistant internal parts and stainless steel springs; two independently operating check valves with intermediate atmospheric vent.
2. Size: 3/4 to 2 inch, NPS assembly with threaded full port ball valves.

C. Double Check Valve Assembly:

1. ASSE 1015 and NSF 61 compliant lead-free bronze body with corrosion resistant internal parts and stainless steel springs; two independently operating check valves with intermediate atmospheric vent.
2. Size: 3/4 to 2 inch, NPS assembly with threaded full port ball valves.

2.12 WATER HAMMER ARRESTORS

A. Manufacturers:

1. AMTROL, Inc.
2. Josam Company.
3. Sioux Chief Manufacturing Company, Inc.
4. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.
5. Watts Regulator Company, a part of Watts Water Technologies: www.wattsregulator.com/#sle.
6. Tyler Pipe; Wade Div.
7. Zurn Industries, LLC: www.zurn.com/#sle.
8. Substitutions: See Section 22 0500 - Plumbing General Provisions.

B. Water Hammer Arrestors:

1. Copper construction, bellows type sized in accordance with PDI-WH 201, precharged suitable for operation in temperature range minus 100 to 300 degrees F and maximum 250 psi working pressure.

2.13 SANITARY WASTE INTERCEPTORS

A. Manufacturers:

1. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.
2. MIFAB, Inc: www.mifab.com/#sle.

3. Zurn Industries, LLC: www.zurn.com/#sle.
4. Substitutions: See Section 22 0500 - Plumbing General Provisions .

B. Oil Interceptors:
1. Construction:
a. Material: Epoxy coated fabricated steel.
b. Rough-in: Fully recessed flush with floor (deep rough-in) with anchor flange.
c. Cover: Cast iron, epoxy coated, non-skid with gasket, securing handle, and enzyme injection port, recessed for floor finish, H20 rated.
2. Additonal Manufacturers:
a. Striem; OS series.

C. Sand/Oil Interceptors:
1. Description: Factory-fabricated, concrete body.
2. Basis of design: "The Interceptor" by Monarch Products.
3. Construction:
a. Material: Precast concrete.
b. Rough-in: Fully recessed; field adjusted risers.
c. Cover: Cast iron or steel grates for anticipated load in excess of two tons.
4. Features:
a. Inlet, Outlet, Vent, and Waste-Oil Outlet Piping Connections: Hub, hubless, or threaded, unless otherwise indicated.
b. Extension: Concrete, full size of interceptor, extending from top of interceptor to grade.
5. Manufacturers:
a. Cactus Concrete of Williston, North Dakota.
b. Monarch Products Co. of Mandan, North Dakota
c. Dickinson Ready Mix Co. of Dickinson, North Dakota.
d. Substitutions: See Section 22 0500 - Plumbing General Provisions.

D. Grease Interceptors:
1. Construction:
a. Material: High-density polyethylene.
b. Rough-in: Fully recessed (shallow rough-in) with anchor flange.
c. Cover: Steel, epoxy coated, non-skid with gasket, securing handle, and enzyme injection port, recessed for floor finish.
2. Additional Manufacturers:
a. Schier Products.
b. Substitutions: See Section 22 0500 - Plumbing General Provisions.

E. Sand/Sediment Interceptors:
1. Description: Floor recessed interceptor suitable for shop and parking garage applications.
2. Epoxy coated cast iron body and secured cover with removable stainless steel sediment bucket.

F. Sediment Traps:
1. Description: Under sink mount sediment interceptor in lieu of fixture 'P' trap.
2. Composite body and secured cover with removable PVC sediment bucket and removable PVC 3/32" diameter perforated screen; low inlet, high outlet.

2.14 WASHER DRAIN TROUGH

A. Description: Drain trough for commercial washers with removeable filter basket. Above grade or below grade installation.

B. Manufacturers:
   1. Striem Co.
   2. Substitutions: See Section 22 0500 - Plumbing General Provisions.

C. Construction:
   1. Cover: Removable, 450 lb weight limit minimum.
   2. Outlet: Plain end, 3” in size except when otherwise noted on Drawings.
   3. Body: HDPE, 3/4” walls, 1/8” per foot internally sloped floor.
      a. Provide rebar anchor gussets for below grade installation.

D. Filtration: Dual filters.
   1. Primary filter: Removable screen with 1/4" perforations and overflow protection.
   2. Secondary filter: Removable basket with 1/4” perforations and overflow protection.

2.15 DRAIN TEMPERING VALVE

A. Description: Device for tempering high temperature waste water by introducing cold water into waste water stream.

B. Manufacturers:
   1. ThermOmegaTech.

C. Body Material: Non-corrosive, such as brass or stainless steel.

D. Operation: 300 series stainless steel thermal actuator.

E. Full Open Temperature: 130°F.
   1. Closing temperature is 10°F below opening temperature.

2.16 MIXING VALVES

A. Digitally Controlled Thermostatic Master Mixing Valves:
   1. Manufacturers:
      a. Lawler Manufacturing Co., Inc.
      b. Leonard Valve Company: www.leonardvalve.com/#sle.
      c. Powers; Watts Water Technologies, Inc.
      d. Symmons.
      e. Substitutions: See Section 22 0500 - Plumbing General Provisions.
   2. Valve: Rough bronze finish, cast brass body, stainless steel or copper alloy bellows, integral temperature adjustment.
      a. Temperature Range: 90-130 degrees F, lockable.
      b. Operation: Thermostatic, fail to cold output.
   3. Accessories:
      a. Strainer stop checks on inlets.
      b. Stem thermometer on outlet.
   4. Cabinet: 16 gauge, 0.0598 inch prime-coated steel, for recessed mounting with hinged door.

B. Automatic Temperature Control Mixing Valves:
   1. Description: Primary domestic hot water mixing station with digitally controlled mixing valve incorporated into a factory assembled and tested pre-piped manifold system.
   2. Manufacturers:

a. Powers; Watts Water Technologies, Inc.
b. Substitutions: See Section 22 0500 - Plumbing General Provisions.

3. Valve: Cast brass body with rough bronze finish, actuator operated, integral temperature adjustment.
4. Controller: Programmable on site without special equipment. Modulate valve to control outlet temperature. Control recirculation pump based on user-set return temperature limits.
   a. Outlet Temperature Control: Adjustable between 80-140°F, setpoint of 120°F, password protected. Digitally monitor inlet and outlet temperatures.
   b. Display: Full color, touch-screen.
   c. Setpoint Adjustments: Ability to receive setpoints from BAS.
   d. Reporting: Send inlet and outlet temperatures to BAS.
5. Accessories:
   a. Shut-off valve on outlet.
   b. Stem thermometer on outlet.
   c. Wet rotor hot water recirculation pump.
6. Cabinet: 16 gauge, 0.0598 inch prime-coated steel, for surface mounting with hinged door.

2.17 RELIEF VALVES

A. Manufacturers:
   1. ITT Bell & Gossett: www.bellgossett.com/#sle.
   2. Substitutions: See Section 22 0500 - Plumbing General Provisions.
B. Bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labelled.

2.18 FLOOR DRAIN TRAP SEALS

A. Manufacturers:
   1. Green Drains; GD4: www.greendrains.com/#sle.
   2. MIFAB, Inc; MI-GARD: www.mifab.com/#sle.
   3. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.
   4. Substitutions: See Section 22 0500 - Plumbing General Provisions.
B. Description: Push-fit EPDM or silicone fitting with a one-way membrane.

2.19 ELECTRONIC TRAP-SEAL PRIMER ASSEMBLY

A. Description: Trap-seal primer assembly with solenoid valve, controller, vacuum breaker, distribution manifold, and cabinet.
B. Manufacturers:
   1. MIFAB, Inc; MI-100: www.mifab.com/#sle.
   2. Precision Plumbing Products, Inc..
   3. Sioux Chief Manufacturing Company, Inc.
   4. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   5. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
   6. Substitutions: See Section 22 0500 - Plumbing General Provisions.
C. Features:
   1. Vacuum breaker: Anti-siphon atmospheric.
   2. Valve: Stainless steel solenoid, UL listed.
   3. Cabinet: 12"x12" metal NEMA 1 with cover plate.
   4. Inlet: Single point with shut-off valve.

5. Manifold: Copper; number of ports as scheduled.
6. Controller: 24-hour timer, test button.

D. Electrical Characteristics: As scheduled on Drawings.

2.20 ELECTRONIC TRAP-SEAL PRIMER

A. Description: Solo prime electronic trap priming system.

B. Manufacturers:

1. Precision Plumbing Products, Inc..

C. Construction: Physical air gap, stainless steel solenoid valve.

D. Electrical Characteristics: As scheduled on Drawings.

E. Accessories:

1. Cabinet: 16 gauge, 0.0598 inch prime-coated steel, for recessed mounting with hinged door.

2.21 PIPE HEATING CABLES

A. Description: Self-regulating heating cable for freeze protection and de-icing with controller.

B. Manufacturers:

1. Easy Heat; a division of EGS Electrical Group LLC.
2. Raychem; a brand of Tyco Thermal Controls LLC.
3. Substitutions: See Section 22 0500 - Plumbing General Provisions.

C. Wires: 16 AWG copper, tinned, stranded.

D. Electrical Insulating Jacket: Flame-retardant polyolefin.

E. Cable Cover: Tinned-copper braid and polyolefin outer jacket.

F. Maximum Operating Temperature (Power On): 125°F.

G. Maximum Exposure Temperature (Power Off): 150°F.

H. Cable Installation Accessories: Fiberglass tape, heat-conductive putty, cable ties, silicone end seals and splice kits, and installation clips all furnished by manufacturer, or as recommended in writing by manufacturer.

I. Capacities and Characteristics: Maximum Heat Output: 8 W/ft.

J. Electrical Characteristics for Single-Circuit Connection: 120/1/60 with 15 amp maximum overcurrent protection.

K. Controller:

1. Inputs: Factory provided precipitation and temperature sensors for snow melting on roofs and in gutters.
2. Enclosure: Corrosion-proof and waterproof enclosure suitable for outdoor mounting, for controls and precipitation and temperature sensors.
3. Remote Controller: Automatic control with manual on, automatic, and standby/reset switch; indication of operation status, on/off.

L. Sequence of Controls:

1. Temperature Span: Below 38 °F.
2. Delay-Off Span: minimum of 30 minutes.
3. Energize Cables: If ambient temperature is below set point and precipitation is detected.
4. De-Energize Cables: On detection of a dry surface plus time delay.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. 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.

1. Pipe relief from backflow preventer to nearest drain.
2. Locate backflow preventers in same room as connected equipment or system.
3. Do not install bypass piping around backflow preventers.
4. Test each pressure vacuum breaker, backflow preventer according to authorities having jurisdiction and the device's reference standard.

C. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to fast closing valves such as flush valves.

3.02 DRAINS

A. Protect drains during construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Trench drains shall be furnished by this Contractor and turned over to the General Contractor for installation. This Contractor shall provide all piping.

C. Floor Drains:

1. Set grates flush with finished floor, unless otherwise indicated.
2. Size same as drainage piping.
3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.

D. Roof Drains:

1. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions.
2. Install flashing collar or flange of roof drain to prevent leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
3. Install expansion joints, if indicated, in roof drain outlets.
4. Position roof drains for easy access and maintenance.
5. Roof drain schedule:
    a. Domed Roof Drains: Limited access roofs.
    b. Small-Sump Body: 4” conductor size and smaller.
    c. Standard-Sump Body: 8” conductor size and smaller.
    d. Large-Sump Body: 10” up to 16” conductor size.
6. Promenade Roof Drains: Sun deck style roof, accessible to non-service personal.
7. Fabricate flashing from single piece of metal unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
    a. Lead Sheets: Burn joints of 6.0-lb/sq. ft. lead sheets, 0.0938-inch thickness or thicker. Solder joints of 4.0-lb/sq. ft. lead sheets, 0.0625-inch thickness or thinner.
    b. Copper Sheets: Solder joints of copper sheets.
8. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

9. Pipe Flashing: Sleeve type, matching the pipe size, with a minimum length of 10 inches and with skirt or flange extending at least 8 inches around pipe.
10. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
11. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.
12. Set flashing on roofs in solid coating of bituminous cement.
13. Secure flashing into sleeve and specialty clamping ring or device.
14. Fabricate and install flashing and pans, sumps, and other drainage shapes.

E. Downspouts:
1. Install downspout adapters on outlet of back-outlet parapet roof drains and connect to sheet metal downspouts.
2. Install downspout nozzles to discharge at 12” above grade.

3.03 CLEANOUTS

A. Extend cleanouts to finished floor or wall surface.
B. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil.
1. Ensure clearance at cleanout for rodding of drainage system.
C. Encase exterior cleanouts in concrete flush with grade.
D. Floor Cleanouts: Install at elevation to accommodate finished floor.
E. Wall Cleanouts: Install chrome access covers.
F. Location:
1. At each aggregate change in direction of piping greater than 135 degrees.
2. Intervals of 75 feet, minimum.
3. At base of each vertical soil and waste stack.
G. Sizing Schedule, unless otherwised indicated:
1. Up to 4" Drain Pipe : Size same as drainage piping.
2. Above 4" up to 6": 4” cleanout.
3. Above 6": 6” cleanout, unless larger is indicated.

3.04 P-TRAP PRIMER

A. Install solo trap primers in accessible locations.
B. Provide a water hammer arrester in the branch piping upstream of the solenoid valve.
C. Install the trap primer device a minimum of 12” above the finished grade of the drain it serves, measured from the bottom of the air gap or vacuum breaker. Trap primer should be mounted 12” higher for every additional 20’ of trap priming line, measured from the bottom of the air gap or vacuum breaker. Field verify lengths of priming lines prior to mounting priming device.
D. Install with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting.
E. Adjust integral timer controls per installation instructions and drain requirements.

3.05 MASTER MIXING STATION

A. Install per manufacturer instructions.
B. Electrical power connection by the Electrical Contractor.
C. This contractor is responsible for all low voltage and control wiring required by the unit.
D. Mount to wall or on supports mounted on a 4” concrete housekeeping pad.

3.06 SANITARY WASTE INTERCEPTORS

A. Interceptor mounted flush with concrete floor shall be furnished by this Contractor and turned over to the General Contractor for installation. This Contractor shall provide all piping and accessories.

B. It is this Contractor's responsibility to field verify all piping inverts into and out of the interceptors to provide the correct extension/riser lengths to maintain the scheduled minimum solid and liquid capacities. Extension/riser lengths shall not result in reduced interceptor capacity.

C. Unless otherwise noted, install cleanouts at the inlets and outlets of all interceptors.

D. Install all interceptors with clear space for servicing.

E. Grease Interceptors:

1. Install grease interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.
2. Flush with Floor Installation: Set unit and extension, if required, with cover flush with finished floor.
3. Install cleanout immediately downstream from interceptors not having integral cleanout on outlet.

3.07 DRAIN TEMPERING VALVE

A. Install a water hammer arrestor immediately upstream of the tempering valve.

B. Install a checkvalve backflow preventer upstream of the tempering valve.

3.08 HEATING CABLES

A. Perform the following tests and inspections:

1. Perform tests after cable installation but before application of coverings such as insulation, wall or ceiling construction, or concrete.
2. Test cables for electrical continuity and insulation integrity before energizing.
3. Test cables to verify rating and power input. Energize and measure voltage and current simultaneously.

B. Repeat tests for continuity, insulation resistance, and input power after applying thermal insulation on pipe-mounted cables.

C. Remove and replace damaged heat-tracing cables.

END OF SECTION

SECTION 22 1329 - SANITARY SEWERAGE PUMPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submersible sewage pumps.

B. Sewage pump basins and pits.

1.02 REFERENCE STANDARDS

A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; 2015 (Reaffirmed 2020).

B. ABMA STD 11 - Load Ratings and Fatigue Life for Roller Bearings; 2014 (Reaffirmed 2020).

C. ICC (IPC) - International Plumbing Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. NEMA MG 00001 - Motors and Generators; 2024.

1.03 SUBMITTALS

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

B. Shop Drawings: Include dimensions and performance data.

C. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

1.04 WARRANTY

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

B. Manufacturer's standard form in which manufacturer agrees to repair or replace components that fail in materials or workmanship within specified period.

1. Warranty Period: Not less than one year from the date of Substantial Completion.

PART 2 PRODUCTS

2.01 SUBMERSIBLE SEWAGE PUMPS

A. Manufacturers:

1. Grundfos Pumps Corporation: www.grundfos.com/#sle.
2. Weil Pump Company, Inc: www.weilpump.com/#sle.
3. Zoeller Company: www.zoeller.com/#sle.
4. Substitutions: See Section 22 0500 - Plumbing General Provisions.

B. Description: Submersible centrifugal pump made of rugged stainless steel and cast-iron housing and base with oil-filled motor chamber, ball bearings, and mechanical seal.

C. Casing:

1. Capable of withstanding pressures 50 percent greater than maximum operating pressure.
2. Volute: Consisting of smooth passages providing unobstructed flow through pump.
3. Exposed Nuts and Bolts: Stainless steel construction.
4. Finish: Protect casing exterior surfaces in contact with sewage using sewage-resistant coal tar epoxy coating.

D. Pump Shaft: Fabricate of high-grade alloy steel of adequate strength and size, with application-appropriate safety factor to transmit full driver horsepower. Include shaft key so that impeller cannot be loosened by either reverse or forward torque.

E. Impeller:
   1. Bronze; open non-clog, stainless steel shaft, single shrouded to minimize clogging due to heavy sludge found in sewage.
   2. Securely keyed to shaft with locking arrangement preventing loosening by torque from either forward or reverse direction.
   3. Balance statically, dynamically, and hydraulically within recommended operating range from duty point.
F. Wear Rings: Renewable; provided on casing and impeller with wearing surfaces normal to axis of rotation. Material suitable for ease of maintenance and secured to prevent rotation.
G. Bearings:
   1. Provide roller type capable to handle multi-directional thrust loads.
   2. Do not use pumps dependent on thrust and hydraulic balance.
   3. Bearing Life: L-10, 50,000 hours minimum, complying with ABMA STD 9 or ABMA STD 11.
H. Seals:
   1. Provide tandem mechanical shaft seal system running in oil bath.
I. Motor:
   1. Base-mounted, enclosed, lubricated oil-free, thermal-overload protected, continuous-duty, permanent split capacitor with oil-resistant, three-prong connector, 6-foot power cord.
   2. Watertight with Class F insulation, NEMA B design, complying with NEMA MG 00001.
   3. Provide oil filled, air filled with water jacket, or air filled with cooling fins that encircle stator housing.
J. Power Cable:
   1. Enters through heavy-duty entry assembly provided with internal grommet assembly to prevent leakage.
   2. Separate motor and cable entry junction by terminal board or stator lead sealing gland that prevents foreign material from gaining access to motor interior through top of pump.
   3. Standard construction for submersible pump applications; do not use materials consisting of silicones.
K. Controls: Integral, chemically-resistant, vertical plated-steel rod float switch. Cycle pump ON/OFF between 2.5- and 9-inch heights from bottom of pump.
L. Solids Handling Capacity: Pass lint and other small solids up to 2 inch in size.
M. Discharge Pipe Size: 2 inches, NPT, female.
N. Maximum Water-Based Effluent Temperature: 120 degrees F.
O. Accessories: Provide reverse flow assembly and high-level audio/visual alarm system.

2.02 SEWAGE BASINS AND PITS

A. Simplex Basin:
   1. Simplex Basin Diameter and Height: 18 by 30 inches.
   2. Molded-Finish Requirements: Hard bottom, watertight, gastight, and radon-tight molding.
   3. Basin Material: Polyethylene structural-foam, heavy-duty injection-molded.
   4. Below Ground Pipe Inlet: Molded or predrilled with seal, 3 inches.
   5. Maximum Waste Effluent Temperature: Match or exceed maximum pump service temperature.
   6. Basin Cover: 1-1/4-inch discharge, 1-1/2-inch vent, and cord grommet openings with hubs.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products with related fittings and accessories according to manufacturer instructions.

B. Provide accessories required to complete installation in accordance with ICC (IPC).

3.02 PROTECTION

A. Protect installed products from damage due from subsequent construction operations.

B. Repair or replace products damaged before Date of Substantial Completion.

END OF SECTION

SECTION 22 1429 - SUMP PUMPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submersible sump pumps.

B. Submersible sump pumps - elevator pit.

C. Sump basins and pits.

1.02 REFERENCE STANDARDS

A. ICC (IPC) - International Plumbing Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.03 SUBMITTALS

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

B. Shop Drawings: Include dimensions and performance data.

C. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

PART 2 PRODUCTS

2.01 SUBMERSIBLE SUMP PUMPS

A. Manufacturers:

1. Bell & Gossett Domestic Pump; ITT Corporation.
2. Goulds Pumps; ITT Corporation.
3. Grundfos Pumps Corporation: www.grundfos.com/#sle.
4. Pentair Pump Group; Hydromatic Pumps.
5. Little Giant Pump Co.
6. Weil Pump Company, Inc.
7. Zoeller Company: www.zoeller.com/#sle.
8. Substitutions: See Section 22 0500 - Plumbing General Provisions.

B. General: Rugged stainless steel and cast iron housing and base with oil-filled motor chamber, ball bearings, and mechanical seal.

C. Impeller: Thermoplastic; open nonclog, stainless steel shaft.

D. Motor: Base mount, enclosed, lubricated oil-free, thermal-overload protected, continuous duty, permanent split capacitor with oil-resistant, three-prong connector, 10 foot power cord.

E. Controls: Integral, chemically-resistant, vertical plated-steel rod float switch. Cycle pump Off/On between 2.5 and 9 inch heights from bottom of pump.

F. Solids Handling Capacity: Pass lint and other small solids up to 1/2 inch in size.

G. Discharge Pipe Size: 2 inch, NPT, female.

H. Maximum Water-Based Effluent Temperature: 120 degrees F.

I. Accessories: Provide full flow swing-type discharge check valve.

2.02 SUBMERSIBLE SUMP PUMP - ELEVATOR PIT

A. Description: Elevator pump control system approved for oil/water detection in applications where oil and hydrocarbons are prohibited from being released into the environment. Complete packaged system with pump, lighted indicators, remote alarm, and auxiliary contacts for connection to BAS.

B. Manufacturers:
   1. Pentek; Pentair Ltd.
   2. Substitutions: See Section 22 0500 - Plumbing General Provisions.

C. Basis of Design: Pentek ODS Series.

D. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal sump pump.

E. Pump Casing: Cast iron, with strainer inlet, legs that elevate pump to permit flow into impeller, and vertical discharge for piping connection.

F. Impeller: Statically and dynamically balanced, bronze design for clear wastewater handling.

G. Motor: Hermetically sealed, capacitor-start type; with built-in thermal overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.

H. Controls:
   1. Enclosure: NEMA 250, Type 1.
   2. Battery Backup: Provide.
   3. Sensor: Pressure type switch for low water detection, with mounting bracket and electric cables; conductive type sensor to detect presence of oil; float switch for high water detection.
   4. Indicator lights: Power on, pump on, high water, high oil indicators.
   5. Remote Alarm Contacts: For remote alarm interface.
   6. Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:
      a. On-off status of pump.
      b. Alarm status.
   7. Sequence of Operation: On water rise, level reaches pump “start” probe to start the pump. Pump will remain on until level is below “off” probe. The “off” probe senses air or oil and turns the pump off so that oil layer will not be pumped out of the sample if the link. If the liquid level reaches alarm probe and mechanical float, the system of differentiate between water and oil and activate the remote alarm.

2.03 SUMP BASINS AND PITS

A. Sump Basin:
   1. Below Ground Pipe Inlet: Molded or predrilled with seal, 4 inch.
   2. Basin Dimensions: 18 inch diameter, 22 inch deep.
   3. Basin Material: Polyethylene structural foam, heavy duty injection molded.
   4. Molded-Finish Requirements: Hard bottom, watertight, gas-tight and radon-tight molding.
   5. Maximum Effluent Temperature: Match or exceed maximum pump service temperature.
   6. Basin Riser Extension: Diameter matched, 6 inch with hardware.
   7. Basin Cover:
      a. Material: One-piece flat lid made of polyethylene with seal gasket.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products with related fittings and accessories according to manufacturer instructions.

B. Observe and provide incidentals required to complete installation in compliance with ICC (IPC).

3.02 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Operational Tests: Conduct operating tests to demonstrate satisfactory, functional, and operating efficiency.

3.03 PROTECTION

A. Protect installed products from damage from subsequent construction operations.

END OF SECTION

SECTION 22 1500 - GENERAL-SERVICE COMPRESSED-AIR SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Reciprocating air compressors.
B. System filters.
C. Air receivers.
D. Pipe and fittings.
E. Unions and couplings.
F. Air outlets.

1.02 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. 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; 2024.
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 D2513 - Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings; 2024, with Editorial Revision (2025).
K. ASTM D2683 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing; 2020.
L. ASTM F1281 - Standard Specification for Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene (PEX-AL-PEX) Pressure Pipe; 2025.
M. ASTM F1282 - Standard Specification for Polyethylene/Aluminum/Polyethylene (PE-AL-PE) Composite Pressure Pipe; 2023a.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Shop Drawings: Indicate piping system schematic with electrical characteristics and connection requirements.
C. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Protect piping and equipment from weather and construction traffic.

1.05 WARRANTY

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

PART 2 PRODUCTS

2.01 RECIPROCATING AIR COMPRESSORS

A. Provided by others.

2.02 SYSTEM FILTERS

A. Cartridge Number 1: Coalescing.

B. Location: Downstream of air compressor.

C. Flow Capacity: Match compressor rate.

2.03 AIR RECEIVERS

A. Receiver: Vertical, built to ASME regulations for working pressure of 125 psi. Flange or screw inlet and outlet connections.

B. Fittings: Adjustable pressure regulator, safety valve, pressure gauge, drain cock, and automatic float actuated condensate trap.

2.04 PIPE AND FITTINGS

A. Steel Pipe: ASTM A53/A53M, Grade B, Type E, 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.

B. Steel Pipe: ASTM A53/A53M, Schedule 40 black.

1. Mechanical Press Sealed Fittings: Double-pressed type, utilizing EPDM, nontoxic, synthetic rubber sealing elements.

C. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), drawn.

1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
2. Joints: ASTM B32, solder, Grade Sn95.

D. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), annealed.

1. Joints: Mechanically pressed.

E. Polyethylene Pipe: ASTM D2513, SDR 11.

1. Fittings: ASTM D2683 or ASTM D2513 socket type.
2. Joints: Fusion welded.

F. Polyethylene/Aluminum Composite Pipe: ASTM F1281 or ASTM F1282.

1. Fittings and Joints: Brass compression type.

2.05 UNIONS AND COUPLINGS

A. Unions:

1. Ferrous Pipe: 150 psi malleable iron threaded unions.
2. Copper Tube and Pipe: 150 psi bronze unions with soldered joints.

B. Flexible Connector: Neoprene with brass threaded connectors.

2.06 AIR OUTLETS

A. Quick Connector: 3/8 inch brass, snap-on connector with self closing valve, Style coordinated with Owner.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install equipment in accordance with manufacturer's instructions.

B. Make air cock and drain connection on horizontal casing.
C. Connect condensate drains to nearest floor drain.
D. Install takeoffs to outlets from top of main, with shut off valve after takeoff. Slope takeoff piping to outlets.
E. Install compressed air couplings, female quick connectors, and pressure gauges where outlets are indicated.
F. Install tees instead of elbows at changes in direction of piping. Fit open end of each tee with plug.

3.02 FIELD QUALITY CONTROL

A. See Section 01 4000 - 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 22 3000 - PLUMBING EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Residential electric water heaters.
B. Potable water expansion tanks.
C. Reverse osmosis equipment.
D. In-line circulator pumps.
E. Pressure booster systems.

1.02 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. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels; 2023.

1.03 SUBMITTALS

A. See Section 22 0500 - Plumbing General Provisions for submittals procedures.
B. Product Data:
    1. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.
    2. Provide electrical characteristics and connection requirements.
C. Shop Drawings:
    1. Indicate heat exchanger dimensions, size of tappings, and performance data.
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 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.05 WARRANTY

A. Water Heaters
    1. Manufacturer's standard form in which manufacturer agrees to repair or replace components that fail in materials or workmanship for not less than one year from the date of Substantial Completion.

PART 2 PRODUCTS

2.01 WATER HEATERS

A. Manufacturers:
    1. A.O. Smith Water Products Co: www.hotwater.com/#sle.
    2. Bock Water Heaters, Inc: www.bockwaterheaters.com/#sle.

3. Bradford White Corporation.
4. Rheem Manufacturing Company: www.rheem.com/#sle.
5. State Water Heaters.
6. Substitutions: See Section 22 0500 - Plumbing General Provisions.

B. Residential Electric Water Heaters:
1. Type: Automatic, electric, vertical storage.
2. Minimum Efficiency Required: ASHRAE Std 90.1 I-P.
3. Performance: As scheduled.
4. Electrical Characteristics: As scheduled.
5. Tank: Glass lined welded steel, thermally insulated with one inch thick glass fiber; encased in corrosion-resistant steel jacket; baked-on enamel finish.
6. Controls: Automatic water thermostat with externally adjustable temperature range from 120 to 170 degrees F, flanged or screw-in nichrome elements, enclosed controls and electrical junction box and operating light. Wire double element units so elements do not operate simultaneously.
7. Accessories:
a. Water Connections: Brass.
b. Dip Tube: Brass.
c. Drain valve.
d. Anode: Magnesium.
e. Temperature and Pressure Relief Valve: ASME labeled.

2.02 POTABLE WATER EXPANSION TANKS

A. Manufacturers:
1. Amtrol Inc: www.amtrol.com/#sle.
2. Armstrong Pumps, Inc.
3. Bell & Gossett, a brand of Xylem, Inc: www.bellgossett.com/#sle.
4. Taco, Inc: www.taco-hvac.com/#sle.
5. Wilkins.
6. Watts.
7. American Wheatley, a company of Global Flow Products, LLC; _____: www.wheatleyhvac.com/#sle.
8. Substitutions: See Section 22 0500 - Plumbing General Provisions.

B. Construction: Welded steel, tested and rated for working pressure of 125 psig, with flexible EPDM diaphragm sealed into tank.

C. Accessories: Pressure gauge and air-charging fitting, tank drain; precharge to 12 psig.

2.03 REVERSE OSMOSIS EQUIPMENT

A. Manufacturers:
1. Culligan International Company: www.culligan.com/#sle.
2. HANS Premium Water: www.hanspremiumwater.com/#sle.
3. Marlo Incorporated: www.marlo-inc.com/#sle.
4. Substitutions: See Section 22 0500 - Plumbing General Provisions.

B. Piping, Equipment, and Controls: Factory mounted on steel frame.

2.04 CIRCULATOR PUMPS

A. Manufacturers:
1. Armstrong Fluid Technology: www.armstrongfluidtechnology.com/#sle.

2. Bell & Gossett, a brand of Xylem, Inc: www.bellgossett.com/#sle.
3. Grundfos Pumps Corporation: www.grundfos.com/#sle.
4. Taco, Inc: www.tacocomfort.com/#sle.
5. Thrush Company.
6. Wilo USA, LLC.
7. Substitutions: See Section 22 0500 - Plumbing General Provisions.

B. Wet Rotor Circulators:
1. Casing: Bronze with NPT, union, or flanged connections.
2. Impeller: Non-metallic.
3. Pump Shaft: Ceramic.
4. Pump Bearings: Carbon.
5. Motor: Single or multi-speed stainless steel replaceable cartridge design.

C. Controls: Provide aquastat set for high-temp cutoff, electric plug, and illuminated hand switch.

2.05 PRESSURE BOOSTER SYSTEMS

A. Manufacturers:
1. Armstrong Fluid Technology: www.armstrongfluidtechnology.com/#sle.
2. Bell & Gossett, a brand of Xylem, Inc: www.bellgossett.com/#sle.
3. Substitutions: See Section 01 6000 - Product Requirements.

B. System: Packaged with two pumps, factory assembled, tested, and adjusted; shipped to site as integral unit; consisting of pumps, valves, and galvanized piping, with variable speed drives and control panel mounted on fabricated steel base with structural steel framework.

C. Variable speed drives and station disconnect mounted in NEMA/US Type 1 panel. Standard system hydraulic settings shall include at a minimum the following functions: loss of suction, lack of NPSHa, pump run-out protection, "dead-head" protection, constant pressure setting with variable flow capability, pressure sensor error, overpressure shutdown, and low flow shutdown.

D. Lead Pump: Operate continuously with lag pump running on system demand. If lead pump fails to function, next pump in sequence to start automatically.

E. Time-Delay Relay: Prevent lag pump short cycling on fluctuating demands.

F. Thermal Bleed Circuit with Solenoid Valve: Prevent overheating during low demand.

G. Low-Pressure Control: Stop pump operation if incoming water pressure drops to atmospheric.

H. Pump Switch: Permit manual or automatic operation.

I. Time Clock for Automatic Day-Night Changeover:
1. Day Cycle: Operate system continuously with pressure to fixtures maintained by pressure-reducing valves.
2. Night Cycle: Operate pump intermittently on pressure switch located near pressure tank operating pump for predetermined adjustable time period.

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. Equipment Connections:

C. Domestic 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.
3. Install piping adjacent to water storage tanks to allow service and maintenance.
4. Connect water piping to water storage tanks with unions or flanges and with shutoff valves. Connect tank drains with shutoff valves and discharge over closest floor drains.
    a. Isolation valves: Ball.
    b. Drain Valves: 3/4" ball valve. Include outlet with, or nipple in outlet with threads for garden-hose service, threaded cap, and chain.
5. Install the following devices on tanks as required:
    a. Pressure relief valves.
    b. Temperature and pressure relief valves.
    c. Vacuum relief valves.
    d. Tank vents on nonpressure tanks.
    e. Connections to accessories.

D. Pumps:
1. 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.
2. Hot Water Recirculation Pumps:
    a. Install thermostats in hot-water return piping.
    b. Install timers in accessible location on wall near hot water heater.
    c. Adjust domestic water pumps to function smoothly and lubricate as recommended by manufacturer.
    d. Adjust initial temperature set points.

3.02 WATER HEATERS

A. If any device, fixture, or panel is required to be wall mounted by this contractor, provide AC Plywood, 3/4" or 5/8" thickness, painted both sides with fireproof paint, color to be determined and coordinated with owner. Paint is required even if installed on a non-fire rated wall.

B. Residential, Water Heater Mounting: Install residential, water heaters on floor, or on water-heater stand on floor if required to be elevated 18".

C. Install water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances.
1. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
2. Install shutoff valves on water-supply piping to water heaters and on hot-water outlet piping.
3. Where installing piping adjacent to water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of water heaters.

3.03 FIELD QUALITY CONTROL

A. Cleaning:
1. Clean and disinfect potable-water storage tanks.

2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed, use procedure described in section 22 0500 - Plumbing General Provisions.

END OF SECTION

SECTION 22 4000 - PLUMBING FIXTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flush valve water closets.
B. Tank type water closets.
C. Wall hung urinals.
D. Lavatories.
E. Sinks.
F. Under-lavatory pipe supply covers.
G. Showers.
H. Bi-level, electric water coolers.
I. Mop sinks.
J. Emergency eye and face wash.

1.02 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
B. ASHRAE Std 18 - Methods of Testing for Rating Drinking-Water Coolers with Self-Contained Mechanical Refrigeration; 2008 (Reaffirmed 2013).
C. ASME A112.6.1M - Floor-Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use; 1997 (Reaffirmed 2017).
D. ASME A112.18.1 - Plumbing Supply Fittings; 2024.
E. ASME A112.18.9 - Protectors/Insulators for Exposed Waste and Supplies on Accessible Fixtures; 2011 (Reaffirmed 2022).
F. ASME A112.19.2 - Ceramic Plumbing Fixtures; 2024.
G. ASME A112.19.3 - Stainless Steel Plumbing Fixtures; 2022.
H. ASME A112.19.5 - Flush Valves and Spuds for Water Closets, Urinals, and Tanks; 2022.
I. ASSE 1014 - Performance Requirements for Backflow Prevention Devices for Hand-Held Showers; 2020.
J. ASSE 1070 - Performance Requirements for Water Temperature Limiting Devices; 2020.
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.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.
C. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.04 WARRANTY

A. See Section 01 7800 - 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 plumbing fittings and faucets that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.02 FLUSH VALVE WATER CLOSETS

A. Water Closets:
   1. Vitreous china, ASME A112.19.2, floor mounted, siphon jet flush action, china bolt caps.
   2. Color: White.
   3. Manufacturers:
      a. American Standard, Inc: www.americanstandard-us.com/#sle.
      b. Kohler Company: www.kohler.com/#sle.
      c. Mansfield Plumbing Products LLC: www.mansfieldplumbing.com/#sle.
      d. Zurn Industries, LLC: www.zurn.com/#sle.
      e. Substitutions: See Section 22 0500 - Plumbing General Provisions.

B. Flush Valves:
   1. Manufacturers:
      a. American Standard, Inc: www.americanstandard-us.com/#sle.
      b. Delany Products: www.delanyproducts.com/#sle.
      c. Sloan Valve Company: www.sloanvalve.com/#sle.
      d. Zurn Industries, LLC: www.zurn.com/#sle.
      e. Substitutions: See Section 22 0500 - Plumbing General Provisions.
   2. Manual Operated:
      a. Type: ASME A112.18.1 or ASME A112.19.5; diaphragm type complete with vacuum breaker stops, and accessories.
      b. Supplied Volume Capacity: 1.5 gal per flush.
   3. Concealed Type: Rough brass, exposed parts chrome-plated, wall escutcheon, wheel handle stop.

C. Toilet Seats:
   1. Manufacturers:
      a. American Standard, Inc: www.americanstandard-us.com/#sle.
      b. Bemis Manufacturing Company: www.bemismfg.com/#sle.
      c. Church Seat Company: www.churchseats.com/#sle.
      d. PROFLO: www.ferguson.com/#sle.
      e. Zurn Industries, LLC: www.zurn.com/#sle.
      f. Substitutions: See Section 22 0500 - Plumbing General Provisions.
   2. Plastic: Black finish, open front, extended back, self-sustaining hinge, brass bolts, with cover.

D. Water Closet Carriers:
   1. Manufacturers:
      a. Grohe America, Inc: www.grohe.com/us/#sle.
      b. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.
      c. JOSAM Company: www.josam.com/#sle.
      d. Zurn Industries, LLC: www.zurn.com/#sle.
      e. Watts Drainage.
      f. Substitutions: See Section 22 0500 - Plumbing General Provisions.

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.

2.03 TANK TYPE WATER CLOSETS

A. Manufacturers:
   1. American Standard, Inc: www.americanstandard-us.com/#sle.
   2. Kohler Company: www.kohler.com/#sle.
   3. Mansfield Plumbing Products LLC: www.mansfieldplumbing.com/#sle.
   4. PROFLO: www.ferguson.com/#sle.
   5. Sloan Valve: www.sloanvalve.com/#sle.
   6. Zurn Industries, LLC: www.zurn.com/#sle.
   7. Substitutions: See Section 22 0500 - Plumbing General Provisions.

B. Floor-Mounted Bowl:
   1. ASME A112.19.2; siphon jet, vitreous china, close-coupled closet combination with elongated rim, insulated vitreous china closet tank with fittings and lever flushing valve, bolt caps, vandalproof cover locking device.
   2. Water Consumption: 1.6 gal per flush, maximum.

C. Toilet Seats:
   1. Plastic: Solid, white, enlongated, closed front, slow-closing hinged seat cover, and brass bolts with covers.
   2. Manufacturers:
      a. American Standard, Inc: www.americanstandard-us.com/#sle.
      b. Bemis Manufacturing Company: www.bemismfg.com/#sle.
      c. PROFLO: www.ferguson.com/#sle.
      d. Church Seat Company: www.churchseats.com/#sle.
      e. Zurn Industries, LLC: www.zurn.com/#sle.
      f. Substitutions: See Section 22 0500 - Plumbing General Provisions.

2.04 WALL HUNG URINALS

A. Manufacturers:
   1. Crane.
   2. American Standard, Inc: www.americanstandard-us.com/#sle.
   3. Kohler Company: www.kohler.com/#sle.
   4. PROFLO: www.ferguson.com/#sle.
   5. Zurn Industries, LLC: www.zurn.com/#sle.
   6. Sloan.
   7. Toto.
   8. Substitutions: See Section 22 0500 - Plumbing General Provisions.

B. Vitreous china, ASME A112.19.2, wall hung with side shields and concealed carrier.
   1. Trapway Outlet: Integral.

C. Flush Valves:
   1. Manufacturers:
      a. American Standard, Inc: www.americanstandard-us.com/#sle.
      b. Delany Products: www.delanyproducts.com/#sle.
      c. Sloan Valve Company: www.sloanvalve.com/#sle.
      d. Zurn Industries, LLC: www.zurn.com/#sle.

e. Substitutions: See Section 22 0500 - Plumbing General Provisions.

2. Manual Operated:
   a. Type: ASME A112.18.1 or ASME A112.19.5; diaphragm type, complete with vacuum breaker stops, and accessories.
   b. Supplied Volume Capacity: 1.5 gal per flush.
3. Exposed Type: Chrome-plated, escutcheon, integral screwdriver stop.

D. Urinal Carriers:
1. Manufacturers:
   a. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.
   b. JOSAM Company: www.josam.com/#sle.
   c. Zurn Industries, LLC: www.zurn.com/#sle.
   d. Watts Drainage.
   e. Substitutions: See Section 22 0500 - Plumbing General Provisions.
2. ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded fixture studs for fixture hanger, bearing studs.

2.05 LAVATORIES

A. Manufacturers:
1. American Standard, Inc: www.americanstandard-us.com/#sle.
2. Kohler Company: www.kohler.com/#sle.
3. Mansfield Plumbing Products LLC: www.mansfieldplumbing.com/#sle.
4. Zurn Industries, LLC: www.zurn.com/#sle.
5. Toto.
6. Substitutions: See Section 22 0500 - Plumbing General Provisions.

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 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: www.zurn.com/#sle.
      4) Watts Drainage.
      5) Substitutions: See Section 22 0500 - Plumbing General Provisions.

C. Drop-In Basin:
1. Vitreous China: ASME A112.19.2; self-rimming, white, square shape, front overflow, soap depression, seal of putty, caulking, or concealed vinyl gasket, and white finish. Size as indicated on drawings with 4-inch centerset spacing.

D. Under-Mount Basin:
1. Vitreous China: ASME A112.19.2; white interior, oval shape, front overflow, seal of putty, caulking, or concealed vinyl gasket, and white exterior finish. Size as indicated on drawings.

E. Supply Faucet:

1. Deck Mounted Faucet Manufacturers:
    a. American Standard, Inc: www.americanstandard-us.com/#sle.
    b. Grohe America, Inc: www.grohe.com/us/#sle.
    c. Kohler Company: www.kohler.com/#sle.
    d. PROFLO: www.ferguson.com/#sle.
    e. Zurn Industries, LLC: www.zurn.com/#sle.
    f. Chicago Faucets.
    g. Delta Faucet Company.
    h. Elkay.
    i. Just Manufacturing.
    j. Moen Incorporated.
    k. Substitutions: See Section 22 0500 - Plumbing General Provisions.
2. ASME A112.18.1; chrome plated combination supply fitting with pop-up waste, water economy aerator with maximum flow of 2.2 gpm, indexed handles.

F. Thermostatic Mixing Valve:
1. ASSE 1070 listed with combination stop, strainer, and check valves, and flexible stainless steel connectors.
2. Braided hot and cold water supply lines.

G. Accessories:
1. Offset waste with perforated open strainer.
2. Wheel handle stops.

2.06 SINKS

A. Manufacturers:
1. American Standard, Inc: www.americanstandard-us.com/#sle.
2. Kohler Company: www.kohler.com/#sle.
3. Elkay Manufacturing Co.
4. Just Manufacturing.
5. Franke Kindred Canada.
6. Substitutions: See Section 22 0500 - Plumbing General Provisions.

B. Single Compartment Bowl
1. ASME A112.19.3; 18 gauge, 0.0478 inch thick, Type 302 stainless steel, self rimming and undercoated, with ledge back drilled for trim.
2. Drain: 1-1/2 inch chromed brass.
3. Drain: 3-1/2 inch crumb cup and tailpiece.

C. Double Compartment Bowl:
1. ASME A112.19.3; 18 gauge, 0.0478 inch thick, Type 302 stainless steel, self rimming and undercoated, with ledge back drilled for trim.
2. Drain: 1-1/2 inch chromed brass.
3. Drain: 3-1/2 inch crumb cup and tailpiece.

D. Kitchen Faucets:
1. Manufacturers:
    a. American Standard, Inc: www.americanstandard-us.com/#sle.
    b. Chicago Faucets.
    c. Component Hardware Group, Inc.

d. Delta Faucet Company.
e. Elkay.
f. Grohe America, Inc; _____: www.grohe.com/us/#sle.
g. Just Manufacturing.
h. Kohler.
i. Moen Incorporated.
j. Sloan.
k. T & S Brass and Bronze Works, Inc.
l. Zurn.
m. Substitutions: See Section 22 0500 - Plumbing General Provisions.

2. Single Handle Faucet with Three-Function Pulldown Spray Head:
   a. Type: Deck-mount, swivel faucet with mounting plate.
   b. Spray Functions: Stream, full spray and pause at 1.8 gpm, maximum.
   c. ASME A112.18.1, ADA Standards, and NSF 61 compliant assembly.
   d. Materials: Ceramic disc-cartridge valve on brass body with polished chrome finish.
3. Single Handle Faucet:
   a. Type: Deck-mount, low-arc, swivel faucet with mounting plate.
   b. Spray Type: Full stream spray at 1.5 gpm, maximum.
   c. ASME A112.18.1, ADA Standards, and NSF 61 compliant assembly.
   d. Materials: Ceramic disc-cartridge valve on brass body with polished chrome finish.

E. Accessories: Provide braided water supply lines, slip-joint p-trap, and stainless steel basket strainer.

2.07 UNDER-LAVATORY PIPE SUPPLY COVERS

A. Manufacturers:
1. Plumberex Specialty Products, Inc: www.plumberex.com/#sle.
2. Engineered Brass Company.
3. Insul-Tect Products Co.; a subsidiary of MVG Molded Products.
4. McGuire Manufacturing.
5. Truebro; a brand of IPS Corporation.
6. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.
7. Substitutions: See Section 22 0500 - Plumbing General Provisions.

B. General:
1. Insulate exposed drainage piping including hot, cold and tempered water supplies under lavatories or sinks per ADA Standards.
2. Exterior Surfaces: Smooth nonabsorbent with no finger recessed indentations for easy cleaning.
3. Construction: 1/8 inch PVC with antimicrobial, antifungal and UV resistant properties.
   a. Comply with ASME A112.18.9 for covers on accessible lavatory piping.
   b. Comply with ICC A117.1.
4. Color: White.
5. Fasteners: Reusable, snap-locking fasteners with no sharp or abrasive external surfaces. No cable ties allowed.

2.08 SHOWERS

A. Shower Bay - Individual bay.
1. Manufacturers:
   a. American Standard, Inc: www.americanstandard-us.com/#sle.

b. Florestone Products Co., Inc.
c. Inpro.
d. Swan Corporation.
e. Willoughby.
f. Substitutions: See Section 22 0500 - Plumbing General Provisions.

2. Cabinet: IAPMO Z124 molded cast acrylic, 36 by 36 by 75 inches with stone texture, integral receptor, soap dish, integral seat, removable chrome-plated strainer, tail piece, color as selected.

B. Shower Trim:

1. Manufacturers:
a. American Standard.
b. Chicago Faucets.
c. Component Hardware Group, Inc.
d. Delta Faucet Company.
e. Grohe America, Inc.
f. Kohler.
g. Moen Incorporated.
h. Sloan.
i. Zurn.
j. Substitutions: See Section 22 0500 - Plumbing General Provisions.

2. Single Handle: ASME A112.18.1; lever-handle operated, pressure balanced mixing valve with integral service stops, bent shower arm with adjustable spray ball joint shower head with maximum flow, and escutcheon.

3. Hand-Held Shower Head:
a. ASME A112.18.1, adjustable spray hand-held shower head with swivel fitting with ASSE 1014 backflow preventer.
b. Include 60 inch minimum flexible polished stainless steel hose and in-line vacuum breaker
c. Provide wall bracket to mount hand spray, allowing use of the unit as either a hand-held spray or a fixed shower head.

2.09 BI-LEVEL, ELECTRIC WATER COOLERS

A. Manufacturers:

1. Elkay Manufacturing Company: www.elkay.com/#sle.
2. Haws Corporation: www.hawsco.com/#sle.
3. Halsey Taylor: www.halseytaylor.com/#sle.
4. Oasis International: www.oasiscoolers.com/#sle.
5. Substitutions: See Section 22 0500 - Plumbing General Provisions.

B. Water Cooler: Bi-level, electric, mechanically refrigerated; surface mounted, ADA compliant; stainless steel top, vinyl on 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 gph 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 VAC, 60 Hertz compressor, 6 foot cord and plug for connection to electric wiring system including grounding connector.

C. Bottle Filler: Materials to match fountain.

2.10 MOP SINKS

A. Sink Manufacturers:
   1. Zurn Industries, LLC: www.zurn.com/#sle.
   2. Ferguson Enterprises, Inc.; ProFlo Brand.
   3. Fiat Products.
   4. Florestone Products Co., Inc.
   5. Mustee, E. L., & Sons, Inc.
   6. Swan Corporation.
   7. Substitutions: See Section 22 0500 - Plumbing General Provisions.

B. Material: Cast polymer composite, white.

C. Type: Rectilinear.

D. Tiling Flange Construction: Galvanized steel.

E. Grid Strainer: Dome stainless steel; integral; removable.

F. Dimensions: As indicated on drawings.

G. Accessories:
   1. 5 feet of 1/2 inch diameter plain end reinforced plastic hose.
   2. Hose clamp hanger.
   3. Mop hanger.
   4. 12" stainless splash guard.

H. Faucet:
   1. Standard: ASME A112.18.1/CSA B125.1.
   2. General: Include hot- and cold-water indicators.
      a. Material: Commercial, solid brass.
      b. Finish: Polished chrome plate.
      c. Check Stops: Provide on hot and cold water.
   3. Mounting Type: Back/wall, exposed.
   4. Valve Handle(s):
      a. Non-ADA: 2-inch lever.
   5. Spout: Rigid, pail-hook, wall brace.
      a. Vacuum Breaker: Required for hose outlet.
      b. Spout Outlet: 3/4” hose thread.
   6. Provide hose bibb with backflow preventer for connection to chemical dispenser. See detail on Drawings.

I. Faucet Manufacturers:
   1. American Standard.
   2. Cambridge Brass, Inc.
   3. Chicago Faucets.
   4. Component Hardware Group, Inc.
   5. Delta Faucet Company.
   6. Elkay.
   7. Grohe America, Inc.
   8. Just Manufacturing.
   9. Kohler.
   10. Moen Incorporated.

11. Sloan.
12. T & S Brass and Bronze Works, Inc.
13. Zurn.
14. Substitutions: See Section 22 0500 - Plumbing General Provisions.

2.11 EMERGENCY EYE AND FACE WASH

A. Manufacturers:
   1. Haws Corporation: www.hawsco.com/#sle.
   2. Acorn Engineering Company.
   3. Bradley Corporation.
   4. Chicago Faucets.
   5. Encon Safety Products.
   6. Guardian Equipment Co.
   7. Speakman Company.
   8. Stingray Systems.
   9. Substitutions: See Section 22 0500 - Plumbing General Provisions.

B. Emergency Wash: ANSI Z358.1; wall-mounted, self-cleaning, nonclogging eye and face wash with quick opening, full-flow valves, ABS eye and face wash receptor, twin eye wash heads and face spray ring, ABS dust cover, copper alloy control valve and fittings.

C. Thermostatic Mixing Valve: Thermostatic mixing valve, ASSE 1070 listed, with combination stop, strainer, and check valves, and flexible stainless steel connectors.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.

B. Verify that electric power is available and of the correct characteristics.

C. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

3.02 INSTALLATION

A. Install each fixture with trap, easily removable for servicing and cleaning.

B. Provide chrome-plated rigid or flexible supplies to fixtures with loose key stops, reducers, and escutcheons.

C. Install water supply piping connections. Provide stop on each supply in readily-serviceable location.

D. Install components level and plumb.

E. Install and secure fixtures in place with wall supports and bolts.

F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.

G. Install deep-pattern escutcheons if required to conceal protruding fittings.

H. Seal joints between fixtures and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant to fixture color.

I. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks and lavatories.

3.03 WATER CLOSETS

A. Solidly attach water closets to floor with lag screws. Lead flashing is not intended to hold fixture in place.

B. Install toilet seats on water closets.

3.04 LAVATORIES

A. Install water temperature limiting devices on all public lavatories.

B. Install supports, affixed to building substrate, for wall-mounted lavatories.

3.05 WATER COOLERS

A. For fixtures indicated for children, install at height required by authorities having jurisdiction.

B. Install water-supply piping with shutoff ball valve on supply to each fixture to be connected to domestic-water distribution piping. Install valves in locations where they can be easily reached for operation.

C. Where a bottle filler is installed in a stand-alone application in a staff break room or other, coordinate the height and location of the fixture to ensure it does not interfere with cabinet door swings or drawer opening distances.

3.06 EMERGENCY FIXTURES

A. Assemble emergency plumbing fixture piping, fittings, control valves, and other components.

B. Install shutoff ball valves in water-supply piping to fixtures. Install valves in locations where they can easily be reached for operation.

1. Exception: Omit shutoff valve on supply to emergency equipment if prohibited by authorities having jurisdiction.

C. Install dielectric fitting in supply piping to emergency equipment if piping and equipment connections are made of different metals.

D. Install thermometers in supply and outlet piping connections to water-tempering equipment.

3.07 INTERFACE WITH WORK OF OTHER SECTIONS

A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.08 ADJUSTING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

B. Operate and adjust fixtures and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

C. Adjust water pressure at bubblers, faucets and flushometer valves to produce proper flow.

D. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

E. Set field-adjustable temperature set points of temperature-actuated water mixing valves. Adjust set point within allowable temperature range.

3.09 CLEANING

A. Clean plumbing fixtures and equipment.

3.10 PROTECTION

A. Protect installed products from damage due to subsequent construction operations.

B. Do not permit use of fixtures by construction personnel.

C. Repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 23 0500 - HVAC GENERAL PROVISIONS

PART 1 GENERAL

1.01 SUMMARY

A. Specification Format

1. These Specifications are written in imperative and abbreviated form. This imperative language of the technical sections is directed at the Contractors, unless specifically noted otherwise. Incomplete sentences shall be completed by inserting "shall", "the Contractor shall", and "shall be", and similar mandatory phrases by inference in the same manner as they are applied to notes on the Drawings. The words "shall be" shall be supplied by inference where a colon (:) is used within sentences or phrases. Except as worded to the contrary, perform all indicated requirements whether stated imperatively or otherwise.
2. Three Part Format
    a. "Part 1 - General": Covers those areas which relate to the Work, and which define the general administrative and technical requirements specific to a particular section.
    b. "Part 2 - Products": Defines, in detail, the acceptance equipment and materials to be incorporated into the Work.
    c. "Part 3 - Execution": Describes, in detail, the manner in which items covered by Part 2 are to be incorporated into the Work.
3. Where Codes, Specifications and Drawings are in conflict, the Contractor will be deemed to have bid the more expensive method. Refer all such discrepancies immediately to the Engineer prior to commencing related work.

B. Definitions:

1. Furnish: Supply equipment as required by these Drawings and Specifications, delivered to the job site for installation or use by others.
2. Install: Fix in position for total operational use all apparatus as shown, specified or required. Provide all miscellaneous fittings and wiring supplies.
3. Or Approved Equal: Equipment or materials selected by Contractor subject to Engineer's acceptance.
4. Or Equivalent: Equipment or materials selected by Contractor matching the function and performance of equipment or materials listed.
5. Provide: Furnish and install in place, total and operational.
6. Complete/Completely: All pipes, fittings, ducts, wiring supplies, and accessories provided for the noted equipment from the equipment to the mains or noted termination points.

1.02 SCOPE OF WORK

A. The work covered by this Division consists in furnishing all labor, equipment, accessories and materials and in performing all operations necessary for the installation of the HVAC systems, in strict accordance with Division 23 of this Specification and applicable Drawings and subject to the terms and conditions of the Contract.

B. Work of this Division is subject to requirements of Instructions to Bidders, General Conditions, Supplementary Conditions, Division One, and all other sections of this Specification.

C. Examine site and all Contract documents prior to submittal of bid.

1. Submittal of a Bid shall indicate the Contractor has examined the Site and Drawings and has included all required allowances in this Bid. No allowance shall be made for errors resulting from the Contractor's failure to visit job sites and to review Drawings.

D. Division 23 Work: Includes, but is not limited to, providing the following:
   1. Hydronic Heating System: Piping, plant equipment, fuel supply, heating equipment.
   2. Air Distribution System: Equipment and ductwork.
   3. Ventilation and Exhaust System: Equipment and ductwork.
   4. Building Automation System.
   5. Insulation System: Ductwork and piping.

1.03 ALTERNATES

A. Refer to Division 1 for alternates.

1.04 CONTINGENCY

A. Refer to Division 01 for amount to include in Mechanical Bid.

1.05 SUBMITTALS

A. General:
   1. Preferred Submittal Format: PDF, unless otherwise noted.
   2. Preferred Submittal Nomenclature: Unless otherwise noted, PDF submittals are to be named according to the following:
      a. [Specification Section Number] – [Specification Name or Equipment Included]
   3. Distribution: Unless otherwise noted, direct all correspondence concerning Division 23 submittals to:
      a. Derek Olesen
      b. PRAIRIE ENGINEERING, P.C.
      c. 1905 17TH STREET SE
      d. MINOT, ND 58701
      e. dolesen@prairieengineeringpc.com

B. Substitution and Prior Approval to Quote:
   1. Format and Content: Complete descriptive technical data on the proposed item consisting of model numbers, type, size and performance characteristics.
   2. Submission Timing: Minimum of 192 hours (eight days) prior to bid opening.
      a. Substitutions will not be permitted after bid opening except where such substitution is considered by the Engineer to be in the best interest of the Owner.
   3. Bidder Notification: Prior to bid opening via Addenda, sent to all planholders.
   4. Contractor Responsibility: This contractor will be responsible for all coordination, construction costs, and Architectural/Engineering design fees required to substitute equipment that has different characteristics than designed including weights, physical dimensions, clearances, mechanical characteristics, electrical characteristics, and other characteristics deemed important to the design by the Architect/Engineer.
   5. Alternative Format: Printed paper, two copies; Self-addressed, stamped envelope required for return reply.

C. Schedule of Values
   1. Distribution: One copy to Engineer.
   2. Format and Content: When included with the Bid, at minimum the following categories shall be indicated:

a. “Project mobilization”
b. “Start-up and Commissioning”
c. “Demolition”
d. “Excavation and Backfill”
e. “Insulation”
f. “Test and Balance”
g. “Building Automation System”
h. “Fire Sprinkler System”
i. “Piping Systems” (all hot/chilled/geothermal piping, valves, fittings, hangers, installed in place)
j. “Sheet Metal” (all ductwork, lining, dampers, hangers, installed in place)
k. “Terminal Units” (unit heaters, grilles, diffusers, radiation, installed in place)
l. “Hydronic Distribution Equipment” (all pumps, boilers, chillers, heating/cooling coils, installed in place)
m. “Air Distribution Equipment” (all fans, air handlers, heat pumps, VAVs, installed in place)

3. Submission Timing: Prior to first payment application.

D. Shop Drawings
1. Distribution: Engineer via the Prime Contractor for each item indicated.
2. Format and Content: Include catalog numbers, performance data, dimensions and other descriptive information.
a. Contractor Review: Dated and signed cover sheet or review stamp for each Shop Drawing file to indicate thorough review. Email message text not acceptable.
b. Submit a separate shop drawing file for each Specification Section including only the items within that Section.
c. Non-Conforming: Returned to Contractor without review.
3. Submission Timing: Prior to delivery of materials to job site.

E. Record Drawings
1. Format and Content: Paper copy of Drawings project site.
a. As work progresses, Contractor's field supervisor shall mark Record Drawings in red pencil to indicate actual conditions of installation.
b. Give particular attention to marking actual locations of underground piping.
c. Affix all addendum and change order descriptions to appropriate record drawing sheet, utilizing spray adhesive.
d. Make Record Drawings available to Engineer during project visitation.
2. Submission Timing: Close of project with Record Manuals.

F. Spare Equipment and Devices
1. Distribution: Owner.
2. Format and Content: List quantities on contractor letterhead or invoice, obtain signature of Owner's representative acknowledging receipt, and include with each Record Manual.
3. Submission Timing: Close of project with Record Manuals.

G. Operation and Maintenance Manuals
1. Submission Timing: Close of project, as condition of its acceptance.
2. Record Manual information shall be included for all equipment/material where Shop Drawings are required.

3. Format and Content: Two copies, Loose-leaf hardcover binders, and in PDF format on CDs or USB drive.
    a. List project name, date, Contractor's name, address and telephone number on exterior label of each Record Manual and CD.
    b. Include an index sheet indicating subcontractor and subcontractor's phone number and each major piece of equipment, supplier and supplier's telephone number. Provide tabbed dividers indicating major groupings of equipment.
    c. Include a copy of the Shop Drawings.
    d. Include all installation, operation and maintenance data packaged with any equipment.
    e. Include all signed and dated final punch lists from walkthroughs performed by the Engineer.

1.06 APPLICATIONS FOR PAYMENT

A. Refer to Division 1 "Applications for Payment".
B. Provide one additional copy, sent directly to the Engineer.
C. Schedule of Values: At minimum, include items in Submittal article.

1.07 CHANGES TO CONTRACT

A. Any required changes to the contract after bid date shall be in accordance with General Conditions/Division 1 and this section. Where any discrepancies between the sections are encountered, the more restrictive section shall apply.
B. Proposed changes shall be accompanied with complete substantiating documentation.
    1. Provide an itemized list of quantities for materials, equipment, and supplies.
        a. Include unit costs for each item and extended price.
        b. Include unit labor for each item and extended time.
    2. Provide subcontractor proposals that include the same substantiating documentation.
    3. Provide quotations from suppliers for any specially ordered equipment.
C. Material costs shall be actual costs to the contractor, obtaining the materials through normal supply channels, including trade and quantity discounts. Utilizing "suggested pricing" from national pricing organizations for unit costs shall not be accepted. Upon request, the contractor or subcontractor shall submit evidence to substantiate the costs.
D. Labor units shall be industry accepted standard labor hours to perform one unit of work. If the work is being performed in a location that is not considered to be standard working conditions for that specific task, additional labor shall be itemized.
E. Labor rates shall be the actual rate paid for the workman category along with associated labor burden. Labor burden shall consist only of the mandatory fringe benefits, labor taxes, and labor insurances as affected by payroll. The owner reserves the right to reject any labor burden which is inconsistent with other similar contractors or where the fringe benefit cost is in excess of established labor agreements.
F. Allowable markups for contractor and subcontractors:
    1. Overhead on work performed by own forces: 12% maximum.
    2. Profit on work performed by own forces: 10% maximum.
    3. Commission on work performed by Subcontractors: 5% maximum.
    4. Sales tax.
    5. Bond and permit increases where applicable.
    6. No additional markups shall be allowed for:
        a. Field and/or office supervision/administration time.
        b. Tool burden.

c. Shop burden.
d. Overhead/Profit applied to work performed by others.

G. Additional costs for travel and subsistence shall only be allowed if the proposal includes a request for extension of the completion date. Furthermore, those costs shall be proportional to the number of working days of the extension.

H. Subcontractors shall compute their costs in the same manner as the contractor. Subcontractors are subject to the same markup constraints as described herein.

I. For changes resulting in credit to the costs, no restocking fees for materials shall be applied by the contractor or subcontractors.

1.08 QUALITY ASSURANCE

A. Qualifications of Installers
1. For installation and testing, use only trained licensed and experienced workmen familiar with items required and manufacturer's recommended methods.
2. In acceptance or rejection of installed work, no allowance will be made for lack of skill on the part of the workmen.

1.09 AUTHORITIES AND AGENCIES

A. Materials, workmanship and installation: comply with the latest editions of all applicable codes, local ordinances, industry standards, utility company regulations, insurance carrier requirements and these Specifications.

B. Obtain and pay all permits, inspections, licenses and other charges pertaining to the Work. Upon completion of the Work, furnish proof of acceptance by proper agency having jurisdiction.

C. Codes and standards shall include, but not necessarily be limited to, the following:
1. International Energy Conservation Code (IECC);
2. Uniform Plumbing Code;
3. North Dakota State Building Code;
4. International Building Code (IBC);
5. International Mechanical Code (IMC);
6. International Fuel Gas Code (IFC);
7. National Fire Protection Association (NFPA) – Sections as adopted by authority having jurisdiction.

D. The more stringent provisions shall govern where provisions of pertinent codes and standards conflict with these Specifications or Drawings. Where Codes, Specifications or Drawings differ with one another, the Contractor will be deemed to have bid the more expensive method. Refer all such discrepancies to the Engineer immediately.
1. Pertinent codes and standards shall not be cited to furnish less than specifically shown or specified.
2. Meeting the minimum standards of the above Codes does not permit a lower grade of construction where Plans or Specifications call for workmanship or materials in excess of Code Requirements.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.10 GUARANTEE AND WARRANTY

A. Except where otherwise noted, contractor shall guarantee materials, workmanship and the proper operation of equipment for a period of one year after Owner's beneficial use of the building or

mechanical system. Contractor shall correct all equipment, material and workmanship found to be defective or non-conforming to the contract documents without cost to Owner during that one year period.

B. Guarantee shall include trips to the project site by Contractor to adjust mechanical equipment as required, ensuring it is operating as intended.

C. Specified guarantee shall not relieve Contractor from liability arising from improper installation or non-compliance with applicable codes.

1.11 TEMPORARY FACILITIES

A. Refer to Special Conditions and/or Division 1 for details of temporary facilities.

1.12 NOMENCLATURE

A. Pipe sizes listed are nominal pipe sizes throughout this Division except where otherwise noted.

PART 2 PRODUCTS

2.01 MATERIAL

A. Material and equipment shall be as shown or specified. Provide material not specifically described but required for a complete and proper installation of the Work, subject to the acceptance of the Engineer.

B. Owner will not be liable for material installed in non-compliance with codes, standards, and these Contract Documents.

C. Fire Stop System material shall be by 3M “Fire Barrier”, Metacaulk, Hilti, Nelson Firestop Products, or AD Fire.

D. See Division 07 for further details on approved materials.

2.02 ELECTRIC WIRING

A. The Division 23 Contractor shall furnish all motors, special controls and electrical devices as specified herein for proper operation of the equipment furnished.

B. Division 26 Contractor shall furnish and install, as required, disconnects, starters, switches, etc., and do all necessary power and control wiring including the installation of electrical devices such as thermostats, humidistats, remote control panels, etc., furnished separately by Division 23 Contractor, unless otherwise noted in Equipment Specifications or noted in Section 230900.

PART 3 EXECUTION

3.01 GENERAL

A. Engineer, Architect, or Owner shall not be responsible for the means, methods, techniques, sequences or procedures of construction selected by Contractor.

B. Engineer, Architect, or Owner shall not be responsible for safety precautions and programs incidental to work of Contractor.

C. It is the sole responsibility of Contractor to initiate, maintain, and supervise all safety precautions and programs in connection with the Work.

D. In general, it is intended that ductwork and piping be installed parallel to building lines, unless otherwise shown on the Drawings, and that equipment be located symmetrical with the architectural elements of the building.

3.02 SURFACE CONDITIONS

A. Prior to work of each Section of Division 23, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

B. Verify that work of this Division may be installed in accordance with all pertinent codes, regulations and standards.

3.03 PRODUCT HANDLING

A. Protection: Use all means necessary to protect the materials of this Division before, during and after installation and to protect the installed work and materials of all other trades.

B. Plugs: Install in ends of uncompleted piping at end of each day or when work stops.

C. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Engineer and at no additional cost to the Owner.

3.04 COORDINATION

A. Order equipment and material in a timely fashion to assure it is on the job site when required.

B. Coordinate installation of material with schedule of other trades to prevent unnecessary delay in construction schedule.

C. Division 23 piping, duct and equipment installations shall comply with National Electrical Code requirements 110.26 "working spaces" and "dedicated spaces". Mechanical ducts and pipes shall not be installed in the space near electrical panels/equipment de fined as "working spaces" or "dedicated spaces".

3.05 DISCREPANCIES, CONSTRUCTION CONFLICTS AND DRAWINGS

A. Discrepancies
   1. Prior to submitting bid, Contractor shall refer any apparent discrepancies or omissions to Engineer for clarification.
   2. The Architect, Engineer or Owner will not be responsible for any oral instructions or modifications to the contract documents prior to opening of bids.
   3. Written interpretation or clarification will be made by Addenda.

B. Construction Conflicts
   1. Conflicts discovered during construction shall be immediately called to the attention of the Engineer for decision.
   2. Do not proceed with installation in area of question until conflict has been fully resolved.
   3. When so directed by Engineer, Contractor shall make minor adjustment to avoid interferences with other trades. Such minor adjustments shall be performed at no additional cost to the Architect, Engineer or Owner.

C. Drawings
   1. Drawings indicate extent and general layout of mechanical systems for project. Due to small scale, it is not possible to indicate all fittings and accessories that may be required. Provide such fittings and accessories as required to form a complete and operating system in general conformance with Specifications and Drawings.
   2. Exact locations, distances, levels and other conditions will be governed by the structure. Field measurements shall take precedence over the Drawings. Use the Drawings and these Specifications for guidance. Secure the Architect's approval for all changes in locations.
   3. Verify all measurements at site. No compensation will be made because of difference between locations shown on the Drawings and measurements at the building.
   4. Refer to the architectural drawings for dimensions and locations of walls, partitions, doors, windows, ceiling heights, door swings and other details of construction.

3.06 UNDERGROUND UTILITIES

A. Locations of existing underground utilities are based on available site information and are shown approximately. Contractor shall determine exact utility locations before commencing work and shall be responsible for repair of damages resulting from his construction activities to pre-construction condition.

B. Trench and backfill for installation of underground piping to depth shown or required. Remove any accumulated water in excavation by pumping. Shore and brace excavation as required by safety regulations. Provide temporary bridges to maintain normal traffic flow. Excavation and backfill required by mechanical installations shall be accomplished in accordance with Division 31 Specifications by this Contractor.

3.07 OFFSETS

A. Where required to allow clearance of electrical conduit and outlet boxes, beams, etc., to avoid interference with work of other trades, to increase head room under mechanical systems or to improve the appearance of mechanical systems work, this Contractor shall offset his mechanical system as directed by the Architect/Engineer.

3.08 CUTTING AND PATCHING

A. Refer to General Conditions. Unless specifically called out to be performed by other Contractors, the Division 23 Contractor shall perform all cutting and patching required for the installation of material and equipment furnished under his Contract.

B. Opening/holes cut to allow passage of ducts and pipes through concrete floor shall be patched by the Contractor doing the cutting unless indicated otherwise on the Drawings.

C. Fire-Barrier Penetrations

1. Pipe penetrations through fire rated walls and floors shall be sealed with a UL classified Fire Stop System. Fire Stops shall be provided in accordance with the appropriate System No. as it relates to pipe size/Material and wall or floor rating/material.
2. See Specification Section 230510 for other Fire-Barrier Penetration requirements.
3. See Section 2 article “Materials” of this Specification for approved fire stop system material.

D. Openings between ductwork and fire rated walls and floors shall be sealed with fire rated caulking or steel collars on both sides of wall or floor.

E. Restore damaged surfaces to their original condition by skilled mechanics of the trade involved. Contractor at fault shall assume all cost.

F. Use only rotary type drilling tools to cut concrete.

G. Do not endanger the stability of the structure. Do not at any time cut or alter work of any other Contractor without Architect's consent.

3.09 FIELD QUALITY CONTROL

A. Perform field tests and inspections. Test new piping and parts of existing piping that have been altered, extended, or repaired.

B. Low Pressure Hydronic Piping Tests: Maintain constant pressure.

1. Pressure: Minimum of 100 psig.
2. Duration: One hour.

C. Gas Piping Tests:

1. Test gas piping as required by the Authority Having Jurisdiction or the Utility Company.

2. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.

D. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained. Piping will be considered defective if it does not pass tests and inspections.

3.10 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.11 CLEANING

A. Clean interior of duct and piping systems. Remove dirt and debris as work progresses.

B. The hydronic water systems shall be cleaned as follows:

1. The Division 23 Contractor shall arrange for the services of the local area Chemsearch or Garrett-Callahan water treatment specialist to help with chemically cleaning the new piping systems.
2. Division 23 Contractor shall utilize Garrett-Callahan Formula 247 to degrease, descale and generally clean the piping according to the recommendations of the company specialist. After completion of this work, the Contractor shall add the proper quantity of Garrett-Callahan Formula 12L corrosion inhibitor or provide a Nitrite residual of 500-1000 ppm. Equivalent products by Chemsearch, Dearborn, Brentag, or Agassiz Chemical are acceptable.

3.12 INSTRUCTIONS

A. Provide written and oral operating and maintenance instructions to Owner's representatives. The oral instructions shall be given before the Owner occupies the buildings. Instructions to include all building's mechanical systems and equipment.

B. Copies of written operating and maintenance instructions shall be included with each Record Manual.

C. Division 23 Contractor shall coordinate with Owner at Owner's convenience, formal instruction time for contractor personnel to instruct Owner's Representatives on all equipment. Provide similar equipment supplier's instructions where specified thus.

D. Formal instructions shall be video recorded when required by other Sections of this Specification by this Contractor. Format shall be DVD. Formal instruction to be included with each Record Manual, being referenced to and a part of the Manual.

3.13 CLEAN UP

A. Each Contractor shall be responsible for cleaning up after his work, including the removal of all scrap material left on the job by his men or Subcontractors. This will include the removal of all pipe and sheet metal cuttings, pieces of sheet metal, pipe, and insulation and other debris.

B. Clean all heating units, clean and straighten fins on all coils, clean scale, dirt or debris off piping, motors, etc., oil or grease all motors, fan bearings, pump gear boxes, etc., and leave in a clean best possible working condition. Install clean filters in ventilation system prior to turning job over to Owner.

C. After all tests have been made and the mechanical systems are operating properly, this Contractor shall go over the entire system and remove labels from all mechanical equipment.

D. All equipment having finished paint surfaces shall be examined upon completion for scratches and other damage. Touch up all surfaces as required with paint of color to match factory finish.

E. Perform all cleaning as required by other Sections of Division 23.

END OF SECTION

SECTION 23 0513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General construction and requirements.
B. Applications.
C. Single phase electric motors.
D. Three phase electric motors.
E. Shaft grounding rings.
F. Electronically Commutated Motors (ECM).

1.02 RELATED REQUIREMENTS

A. Section 26 2913 - Enclosed Controllers.

1.03 REFERENCE STANDARDS

A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; 2015 (Reaffirmed 2020).
B. IEEE 112 - IEEE Standard Test Procedure for Polyphase Induction Motors and Generators; 2017.
C. NEMA MG 00001 - Motors and Generators; 2024.
D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Provide submittals for loose-shipped motors.
C. Product Data: Provide wiring diagrams with electrical characteristics and connection requirements.

1.05 QUALITY ASSURANCE

A. Comply with NFPA 70.
B. Comply with NEMA MG 1 unless otherwise indicated.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
B. Provide five year manufacturer warranty for motors larger than 20 horsepower.
C. Provide three year manufacturer warranty for premium efficiency motors.
D. Provide 5 year manufacturer warranty for severe duty motors.

PART 2 PRODUCTS

2.01 GENERAL CONSTRUCTION AND REQUIREMENTS

A. Duty: Continuous duty at ambient temperature of 105 °F and at altitude of 1,700 feet above sea level.
B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.
C. Nominal Efficiency:
    1. Open Motor with Two Poles: 82.5.
    2. Open Motor with Four Poles: 82.5.

3. Open Motor with Six Poles: 50.0.
4. Enclosed Motor with Two Poles: 75.5.
5. Enclosed Motor with Four Poles: 82.5.
6. Enclosed Motor with Six Poles: 50.0.

D. Construction:
1. Open drip-proof type except where specifically noted otherwise.
2. Design for continuous operation in 104 degrees F environment.
3. Design for temperature rise in accordance with NEMA MG 00001 limits for insulation class, service factor, and motor enclosure type.

E. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, efficiency.

F. Wiring Terminations:
1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.
2. For fractional horsepower motors where connection is made directly, provide threaded conduit connection in end frame.

G. Single Phase Motor Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation.
1. Automatic
2. reset when motor temperature returns to normal range.

2.02 APPLICATIONS

A. Exception: Motors less than 250 watts, for intermittent service may be the equipment manufacturer's standard and need not comply with these specifications.

B. Single phase motors for shaft mounted fans, oil burners, and centrifugal pumps: Split phase type.

C. Single phase motors for shaft mounted fans or blowers: Permanent split capacitor type.

D. Single phase motors for fans, pumps, blowers, and air compressors: Capacitor start type.

E. Single phase motors for fans, blowers, and pumps: Capacitor start, capacitor run type.

F. Motors located in outdoors, in wet air streams downstream of sprayed coil dehumidifiers, in draw through cooling towers, and in humidifiers: Totally enclosed weatherproof epoxy-treated type.

G. Motors located outdoors and in draw through cooling towers: Totally enclosed weatherproof epoxy-sealed type.

2.03 SINGLE PHASE POWER - SPLIT PHASE MOTORS

A. Starting Current: Up to seven times full load current.

B. Breakdown Torque: Approximately 200 percent of full load torque.

C. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve or ball bearings.

D. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

2.04 SINGLE PHASE POWER - PERMANENT-SPLIT CAPACITOR MOTORS

A. Multiple Speed: Through tapped windings.

B. Open Drip-proof or Enclosed Air Over Enclosure: Class A (50 degrees C temperature rise) insulation, minimum 1.0 Service Factor, prelubricated sleeve or ball bearings, automatic reset overload protector.

2.05 SINGLE PHASE POWER - CAPACITOR START MOTORS

A. Pull-up Torque: Up to 350 percent of full load torque.

B. Motors: Capacitor in series with starting winding; provide capacitor-start/capacitor-run motors with two capacitors in parallel with run capacitor remaining in circuit at operating speeds.

C. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve bearings.

D. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

2.06 THREE PHASE POWER - SQUIRREL CAGE MOTORS

A. Design, Construction, Testing, and Performance: Comply with NEMA MG 00001 for Design B motors.

B. Insulation System: NEMA Class B or better.

C. Testing Procedure: In accordance with IEEE 112. Load test motors to determine free from electrical or mechanical defects in compliance with performance data.

D. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.

E. Thermistor System (Motor Frame Sizes 254T and Larger): Three PTC thermistors embedded in motor windings and epoxy encapsulated solid state control relay for wiring into motor starter; refer to Section 26 2913.

F. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA STD 9, L-10 life of 20,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.

G. Sound Power Levels: To NEMA MG 00001.

H. Weatherproof Epoxy Sealed Motors: Epoxy seal windings using vacuum and pressure with rotor and starter surfaces protected with epoxy enamel; bearings double shielded with waterproof non-washing grease.

I. Nominal Efficiency: As indicated at full load and rated voltage when tested in accordance with IEEE 112.

J. Nominal Power Factor: As indicated at full load and rated voltage when tested in accordance with IEEE 112.

K. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

L. Motors Used with Variable Frequency Controllers:

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
2. Inverter-Duty Motors: Class F temperature rise; Class H insulation.

2.07 SHAFT GROUNDING RINGS

A. Description: Conductive microfiber shaft grounding ring.

1. Meet NEMA MG-1 requirements.
2. Factory installed whenever possible.

B. Basis of Design: AEGIS, model SGR.

C. Type: Minimum of two rows of circumferential fibers on solid ring or split ring.

D. Application: Provide on motors greater than 1 HP.

1. Motors less than 100 HP: Mount ring on either the drive end or non-drive end.
2. Motors 100 HP and above: Two shaft grounding rings, mounted on the drive end and the non-drive end.

2.08 ELECTRONICALLY COMMUTATED MOTORS (ECM)

A. Description: Brushless DC motor with built in speed and torque controls.

B. Rotor: Permanent magnet.

C. Circuitry: Programmable, manage commutation of stator to be always synchronous with rotor.

D. Multispeed Motors: Minimum turndown of 80%.

E. Efficiency: Minimum of 65%.

F. Bearings: Permanently lubricated, heavy duty ball bearings.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.

C. Check line voltage and phase and ensure agreement with nameplate.

3.02 SHAFT GROUNDING RINGS

A. Factory installed by the manufacturer wherever possible.

1. Field installed by installing contractor subject to Engineer’s approval.
2. Provide AEGIS SGR Colloidal Silver Shaft Coating or equal on shafts prior to rings installation per manufacturer’s recommendations.

B. Test in accordance with manufacturer’s recommendations.

C. Install so the aluminum frame maintains an even clearance around the shaft. Conductive microfibers shall be in full circumferential contact with the shaft. Do not use thread lock to secure the mounting screws.

D. Shafts shall be clean and free of any coatings, paint, or other nonconductive material (clean to bare metal).

E. Check the conductivity of the shaft using an ohm meter.

1. Ohms test: Place the positive and negative meter leads on the shaft at a place where the microfibers will contact the shaft. Maximum reading of less than 2 ohms. If the reading is higher, clean the shaft again and retest.

F. Test completed assemblies for a conductive path to ground using an Ohm meter. Place one probe on metal frame of SGR and one probe on motor frame. Motor must be grounded to common earth ground with variable frequency drive according to applicable standards. Verify that test readings comply with manufacturer’s requirements.

END OF SECTION

SECTION 23 0593 - 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 systems.

C. Measurement of final operating condition of HVAC systems.

1.02 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TAB: Testing, adjusting, and balancing.

D. TABB: Testing, Adjusting, and Balancing Bureau.

E. TAB Specialist: An entity engaged to perform TAB Work.

1.03 PROJECT CONDITIONS

A. Partial Owner Occupancy: Owner may occupy completed areas of building before completion of test and balance. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.04 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; 2008, with Errata (2019).

C. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing; 2023.

1.05 QUALITY ASSURANCE

A. Division 23 Contractor shall employ an independent TAB Contractor specializing in total system air and hydronic testing and balancing.

1. All personnel involved in the execution of the work under the TAB Contract shall be experienced and factory-trained specifically in the total balancing of mechanical systems, as well as being regular employees of the TAB Contractor.

B. The following contractors have been pre-approved to bid the TAB work:

1. Air Dynamics; Granville, ND.
2. Balancing Professionals; Fargo, ND.
3. CL Linfoot; Grand Forks, ND.
4. Design Control, Inc.; Fargo, ND.
5. McFarlane, Inc.; Grand Forks, ND.
6. Statera Technical Services; Billings, MT.

C. Calibrate all instruments and provide verification of calibration provided with submittal data.

1.06 SUBMITTALS

A. See Section 01 3000 - 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 Derek Olesen

2. Submit six weeks prior to starting the testing, adjusting, and balancing work.
3. Include at least the following in the plan:
    a. 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.
    b. 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.
    c. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
    d. Final test report forms to be used.
    e. Procedures for formal deficiency reports, including scope, frequency and distribution.

C. 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.

D. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
1. Revise TAB plan to reflect actual procedures and submit as part of final report.
2. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Engineer and for inclusion in operating and maintenance manuals.
3. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
4. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
5. Units of Measure: Report data in both I-P (inch-pound) and SI (metric) units.
6. 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. Project Engineer.
    g. Project Contractor.
    h. Report date.

E. Project Record Documents: Record actual locations of flow measuring stations and balancing valves and rough setting.

1.07 WARRANTY

A. The TAB agency shall provide an extended 90-day warranty after the completion of the TAB work, during which time the Owner or Engineer can request a rebalancing and retesting of any component listed in the report. The TAB agency shall provide a technician to assist the Owner and/or Engineer in making any tests they may require during this time period.

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.

2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
3. SMACNA (TAB).

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.

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 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.

3.04 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. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

E. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

3.05 GENERAL PROCEDURES

A. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

B. Verify interlocked systems are operating in conjunction.

C. Take and report testing and balancing measurements in inch-pound (IP) units.

D. Report deficiencies discovered before and during performance of testing, adjusting and balancing procedures.

E. Provide assistance to mechanical contractor to troubleshoot systems with deficiencies outside the allowable limits set in this Specification.

3.06 AIR SYSTEM PROCEDURE

A. System Diagrams: Include schematic layouts of air distribution systems. Present each system with minimum single-line diagram.

B. Cut insulation for installation of test probes to the minimum extent necessary for TAB procedures.

1. Install and join new insulation that matches removed materials.

C. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts. Rubber or metal snap-in plugs are also acceptable.

D. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.

E. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

F. Measure air quantities at air inlets and outlets.

G. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

H. 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.

I. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

J. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

K. 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.

L. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

M. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.

N. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches positive static pressure near the building entries.

O. For variable air volume system powered units set volume controller to air flow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable air volume temperature control.

P. On fan powered VAV boxes, adjust air flow switches for proper operation.

Q. For belt-drive fans with VFD's, sheave fan as required to attain the design airflow with the VFD set at 60 Hz. Fan VFD shall not be used to balance the airflow.

R. Test and adjust all fresh air quantities to individual heat pumps.

S. Verify that thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and heat generating appliances.

3.07 WATER SYSTEM PROCEDURE

A. Adjust water systems to provide required or design quantities.
   1. Where pumps are controlled by VFD's, use VFD to balance water flow.

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. Measure flow at all automatic flow control valves to verify that valves are functioning as designed.

G. 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.

H. Verify strainers have been flushed until free of all sediment.

I. Verify that startup screens are replaced by permanent screens with indicated perforations.

3.08 DOMESTIC WATER RECIRCULATION SYSTEMS

A. Measure and record flow at all balancing devices to design flow tolerance.

3.09 SCOPE

A. New systems: All components listed below.

B. Test, adjust, and balance the following:
   1. Plumbing Pumps.
   2. HVAC Pumps.
   3. Boilers.
   4. Packaged Roof Top Heating/Cooling Units.
   5. Air Coils.
   6. Terminal Heat Transfer Units.
   7. Air Handling Units.
   8. Fans.
   9. Air Filters.
   10. Air Terminal Units.
   11. 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.
   6. Sheave Make/Size/Bore.

B. V-Belt Drives:
   1. Identification/location.
   2. Required driven RPM.
   3. Driven sheave, diameter and RPM.
   4. Belt, size and quantity.
   5. Motor sheave diameter and RPM.

C. Pumps:
   1. Identification/number.
   2. Manufacturer.
   3. Size/model.
   4. Impeller.
   5. Design flow rate, pressure drop, BHP.
   6. Actual flow rate, pressure drop, BHP.
   7. Discharge pressure.
   8. Suction pressure.
   9. Total operating head pressure.

D. Combustion Equipment:
   1. Boiler manufacturer.
   2. Model number.
   3. Serial number.
   4. Firing rate.
   5. Water inlet and outlet temperatures.

E. Air Cooled Condensers:
   1. Identification/number.
   2. Location.
   3. Manufacturer.
   4. Model number.
   5. Serial number.
   6. Entering DB air temperature, design and actual.
   7. Leaving DB air temperature, design and actual.
   8. Number of compressors.

F. 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.
10. Water flow, design and actual.
11. Water pressure drop, design and actual.
12. Entering water temperature, design and actual.
13. Leaving water temperature, design and actual.
14. Saturated suction temperature, design and actual.

G. Heating Coils:
1. Identification/number.
2. Location.
3. Service.
4. Manufacturer.
5. Air flow, design and actual.
6. Water flow, design and actual.
7. Entering water temperature, design and actual.
8. Leaving water temperature, design and actual.
9. Entering air temperature, design and actual.
10. Leaving air temperature, design and actual.

H. Air Moving Equipment:
1. Location.
2. Manufacturer.
3. Serial number.
4. Arrangement/Class/Discharge.
5. Air flow, specified and actual.
6. Return air flow, specified and actual.
7. Outside air flow, specified and actual.
8. Total static pressure (total external), specified and actual.
9. Sheave Make/Size/Bore.
10. Number of Belts/Make/Size.
11. Fan RPM.

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. Sheave Make/Size/Bore.
8. Number of Belts/Make/Size.
9. Fan RPM.

J. Terminal Unit Data:
1. Manufacturer.

2. Type, constant, variable, single, dual duct.
3. Identification/number.
4. Location.
5. Model number.
6. Size.
7. Minimum static pressure.
8. Minimum design air flow.
9. Maximum design air flow.
10. Maximum actual air flow.
11. Inlet static pressure.

K. 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.

L. Hydronic Systems:
1. Static water pressure at expansion tanks.
2. Glycol Manufacturer
3. Glycol Type
4. Design and actual Concentration % by Weight or Temperature Protected to (°F.)

END OF SECTION

SECTION 23 0713 - DUCT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Duct insulation.
B. Duct liner.
C. Weather barrier coatings.
D. Jacketing and accessories.

1.02 REFERENCE STANDARDS

A. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.
B. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2023.
C. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013 (Reapproved 2019).
D. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014 (Reapproved 2019).
E. ASTM C916 - Standard Specification for Adhesives for Duct Thermal Insulation; 2020.
F. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material); 2019.
G. ASTM C1423 - Standard Guide for Selecting Jacketing Materials for Thermal Insulation; 2021.
H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
I. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.
J. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).
K. SAE AMS3779 - Tape, Adhesive, Pressure-Sensitive Thermal Radiation Resistant, Aluminum Coated Glass Cloth; 2016b.
L. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.
M. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

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: www.jm.com/#sle.
3. Knauf Insulation: www.knaufinsulation.com/#sle.
4. Owens Corning Corporation: www.ocbuildingspec.com/#sle.
5. Substitutions: See Section 23 0500 - HVAC General Provisions.

B. Insulation: ASTM C553; flexible, noncombustible blanket.

C. Vapor Barrier Jacket:
1. Kraft paper with glass fiber yarn and bonded to aluminized film.
2. Moisture Vapor Permeability: 0.02 perm inch, 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. Outdoor Vapor Barrier Mastic:
1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

2.03 GLASS FIBER, RIGID

A. Manufacturer:
1. CertainTeed Corporation: www.certainteed.com/#sle.
2. Johns Manville: www.jm.com/#sle.
3. Knauf Insulation: www.knaufinsulation.com/#sle.
4. Owens Corning Corporation: www.ocbuildingspec.com/#sle.

B. Insulation: ASTM C612; rigid, noncombustible blanket.

C. Vapor Barrier Jacket:
1. Kraft paper with glass fiber yarn and bonded to aluminized film.
2. Moisture Vapor Permeability: 0.02 perm inch, 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 Finish:
1. Cloth: Untreated; 9 oz/sq yd weight, glass fabric.
2. Vinyl emulsion type acrylic, compatible with insulation, black color.

2.04 WEATHER BARRIER COATINGS

A. Weather-Resistive Barrier Coating: Fire-resistive, UV resistant, water-based mastic for use over closed cell polyethylene and polyurethane foam insulation; applied with glass fiber or synthetic reinforcing mesh.
1. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less, Class A, when tested in accordance with ASTM E84.
2. Water Vapor Permeance: Greater than 1.0 perm in accordance with ASTM E96/E96M.
3. Color: As selected by Architect.

2.05 JACKETING AND ACCESSORIES

A. Canvas Jacket: UL listed 6 oz/sq yd plain weave cotton fabric treated with dilute fire-retardant lagging adhesive.

B. Aluminum Jacket:
   1. Manufacturers:
      a. Childers Brand, Specialty Construction Brands, Inc.
      b. Metal Jacketing Systems.
      c. Substitutions: See Section 23 0500 - HVAC General Provisions .
   2. Comply with ASTM B209/B209M, Temper H14, minimum thickness of 0.016 inch with factory-applied polyethylene and kraft paper moisture barrier on the inside surface.
   3. Thickness: 0.016 inch sheet.
   4. Finish: Embossed.
   5. Joining: Longitudinal slip joints and 2 inch laps.
   6. Fittings: 0.016 inch thick die-shaped fitting covers with factory-attached protective liner.

C. Reinforced Tape:
   1. FSK tape suitable for sealing seams between insulation, insulated elbows, and fittings resulting in a tight, smooth surface without wrinkles.
   2. Comply with UL 723 or ASTM E84.
   3. Moisture Vapor Permeability: 0.00 perm inch, when tested in accordance with ASTM E96/E96M.
   4. Finish: Match insulation.

2.06 DUCT LINER

A. Manufacturers:
   1. Aeroflex USA: www.aeroflexusa.com/#sle.
   2. Armacell LLC: www.armacell.us/#sle.
   3. CertainTeed Corporation: www.certainteed.com/#sle.
   4. Ductmate Industries, Inc, a DMI Company: www.ductmate.com/#sle.
   5. Johns Manville: www.jm.com/#sle.
   6. Knauf Insulation: www.knaufinsulation.com/#sle.
   7. Owens Corning Corporation: www.ocbuildingspec.com/#sle.
   8. Substitutions: See Section 23 0500 - HVAC General Provisions .

B. 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.
   2. Maximum Service Temperature: 180 degrees F.
   3. Fungal Resistance: No growth when tested according to ASTM G21.
   4. Apparent Thermal Conductivity: Maximum of 0.28 at 75 degrees F.
   5. Minimum Noise Reduction Coefficients:
   6. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation. Comply with ASTM C916.

D. 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.
3. Rated Velocity on Coated Air Side for Air Erosion: 5,000 fpm, minimum.
4. Minimum Noise Reduction Coefficients:
    a. 1/2 inch Thickness: 0.30.
    b. 1 inch Thickness: 0.45.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. 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.

C. 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.

D. Ducts Exposed in Mechanical Equipment Rooms or Finished Spaces (below 10 feet above finished floor): Finish with canvas jacket sized for finish painting.

E. Exterior Applications: Provide insulation with vapor barrier jacket. Cover with caulked aluminum jacket with seams located on bottom side of horizontal duct section.

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. 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.
3. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
4. 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.

3.02 WALL AND FLOOR PENETRATIONS

A. Roof/Wall Penetrations: Install insulation continuously through roof/wall penetrations.
1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof/wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside flashing at least 2 inches.
4. Seal jacket to roof flashing with flashing sealant.

B. Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

C. Fire-Rated Wall and Partition Penetrations:

1. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

D. Floor Penetrations:

1. For penetrations through fire-rated assemblies, insulate with same procedure as with Fire-Rated Walls.

E. Fire-Barrier Penetrations:

1. Maintain indicated fire rating of walls, partitions, ceilings, and floors at duct penetrations. Seal duct penetrations with Approved firestop materials.
2. Each Penetration shall be sealed by a Certified Installer, or this Contractor is to hire a Certified Installer to perform fire sealing.
3. Each Penetration is to include a legible, permanent label that has the following information:
   a. UL listing
   b. Product used
   c. Name of installer
   d. Name of Contracting Company
   e. Date the seal was installed

3.03 FIRE-RATED INSULATION SYSTEM INSTALLATION

A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.

B. Insulate duct access panels and doors to achieve same fire rating as duct.

C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Division 07.

3.04 SCHEDULES

A. Fiberglass wrap, with FSK jacket:

1. Supply-Air Ducts and Plenums in attics, concealed spaces and unconditioned spaces.
2. Tempered-Fresh-Air Ducts in attic spaces.
3. Exhaust-Air Ducts and Plenums between isolation damper and penetration of building exterior.
   a. Exception: Lined Exhaust-Air Duct from power roof ventilators.
4. Mixed-Air Ducts and Plenums.
5. Return-Air Duct and Plenums in attic spaces.
6. Tempered-Fresh-Air Duct and Plenums in spaces other than attic.
7. Un-tempered Fresh-Air Duct from air-to-air heat exchangers.

B. Fiberglass board, welded board pins, with FSK facing and matching label-less FSK tape:

1. Outdoor-Air Duct and Plenums.
2. Ducts and Plenums in Mechanical Rooms with one of following means of sealing and cladding:
   a. Mastic-canvas-mastic.
   b. Mastic-fiberglass scrim cloth-mastic.
   c. Self-adhering, peel and stick, rubberized bitumen jacket.

C. Minimum Duct Insulation R-Values

1. Supply ducts, installed in unheated attics and exterior: R-12.

2. Supply ducts, installed in unconditioned spaces, ceiling plenums, and crawl spaces: R-6.
    a. Exception: Cooling only supply ducts: R-2.
3. Supply ducts, installed in attic with roof insulation: R-2.
4. Return ducts, installed in unheated attics: R-4.
5. Outside air ducts: R-12.
6. Un-tempered Fresh-Air Ducts: R-4.

D. Insulation not required:
1. Exhaust-Air Duct except as otherwise
2. Return-Air Duct and Plenums in indirectly conditioned spaces.
3. Supply-Air Ducts and Plenums in exposed, conditioned spaces.
4. Tempered-Fresh-Air Ducts.
5. Fibrous-glass ducts.
6. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
7. Factory-insulated flexible ducts.
8. Factory-insulated plenums and casings.
9. Flexible connectors.
10. Vibration-control devices.
11. Factory-insulated access panels and doors.

E. Ducts Exposed to Outdoors:
1. Fiberglass board, with self-adhesive outdoor jacket or aluminum jacket.
2. Supply, Return Ducts and Plenums: 2” thick and 3-lb/cu. ft. nominal density, R-8 minimum.

END OF SECTION

SECTION 23 0716 - HVAC EQUIPMENT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Equipment insulation.

B. Jacketing and accessories.

1.02 REFERENCE STANDARDS

A. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

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 2019).

D. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement; 2007 (Reapproved 2019).

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; 2023.

H. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013 (Reapproved 2019).

I. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type); 2022a.

J. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014 (Reapproved 2019).

K. ASTM C1423 - Standard Guide for Selecting Jacketing Materials for Thermal Insulation; 2021.

L. ASTM C1775 - Standard Specification for Laminate Protective Jacket and Tape for Use Over Thermal Insulation for Outdoor Applications; 2022.

M. ASTM D93 - Standard Test Methods for Flash Point by Pensky-Martens Closed Cup Tester; 2020.

N. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.

O. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.

P. SAE AMS3779 - Tape, Adhesive, Pressure-Sensitive Thermal Radiation Resistant, Aluminum Coated Glass Cloth; 2016b.

Q. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.03 SUBMITTALS

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

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for equipment scheduled.

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. Manufacturers:
   1. CertainTeed Corporation: www.certainteed.com/#sle.
   2. Johns Manville Corporation: www.jm.com/#sle.
   3. Owens Corning Corporation: www.ocbuildingspec.com/#sle.
   4. Knauf Insulation: www.knaufinsulation.com/#sle.
   5. Substitutions: See Section 23 0500 - HVAC General Provisions.

B. Insulation: ASTM C553; flexible, noncombustible.

C. Vapor Barrier Jacket: Kraft paper reinforced with glass fiber yarn and bonded to aluminized film.
   1. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
   2. Secure with self-sealing longitudinal laps and butt strips.

D. Vapor Barrier Lap Adhesive: Compatible with insulation.

E. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

2.03 GLASS FIBER, RIGID

A. Manufacturer:
   1. CertainTeed Corporation: www.certainteed.com/#sle.
   2. Johns Manville Corporation: www.jm.com/#sle.
   3. Knauf Insulation: www.knaufinsulation.com/#sle.
   4. Owens Corning Corporation: www.ocbuildingspec.com/#sle.
   5. Substitutions: See Section 23 0500 - HVAC General Provisions.

B. Insulation: ASTM C612 or ASTM C592; rigid, noncombustible.

C. Aluminum-Foil Laminate Jacket:
   1. Factory-applied, pressure sensitive adhesive jacketing to comply with ASTM C1775.

D. Vapor Barrier Jacket:
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film.
   2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
   3. Secure with self-sealing longitudinal laps and butt strips.
   4. Secure with outward clinch expanding staples and vapor barrier mastic.

E. Vapor Barrier Lap Adhesive: Compatible with insulation.

F. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

2.04 HYDROUS CALCIUM SILICATE

A. Manufacturer:
   1. Johns Manville Corporation; _____: www.jm.com/#sle.
   2. Substitutions: See Section 23 0500 - HVAC General Provisions.

B. Insulation: ASTM C533; rigid molded, asbestos free, gold color.
   1. K Value: 0.40 at 300 degrees F, when tested in accordance with ASTM C177 or ASTM C518.
   2. Maximum Service Temperature: 1,200 degrees F.
   3. Density: 15 pcf.

C. Tie Wire: 0.048 inches stainless steel with twisted ends on maximum 12 inch centers.

D. Insulating Cement: ASTM C449.

E. High Temperature Adhesive: Fire-retardant, sodium silicate based adhesive with fibers treated in compliance with ASTM D93.

2.05 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturer:

1. Aeroflex USA: www.aeroflexusa.com/#sle.
2. Armacell LLC: www.armacell.us/#sle.
3. K-Flex USA LLC: www.kflexusa.com/#sle.
4. Substitutions: See Section 23 0500 - HVAC General Provisions.

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.
2. Maximum Service Temperature: 220 degrees F.
3. Connection: Waterproof vapor barrier adhesive.

2.06 JACKETING AND ACCESSORIES

A. PVC Plastic:

1. Jacket: Sheet material, off-white color.
   a. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
   b. Thickness: 10 mil, 0.010 inch.
   c. Connections: Brush on welding adhesive.
2. Covering Adhesive Mastic: Compatible with insulation.

B. Canvas Jacket: UL listed 6 oz/sq yd plain weave cotton fabric treated with dilute fire-retardant lagging adhesive.

1. Lagging Adhesive: Compatible with insulation.

C. Aluminum Jacket:

1. Comply with ASTM B209/B209M, Temper H14, minimum thickness of 0.016 inch with factory-applied polyethylene and kraft paper moisture barrier on the inside surface.
2. Thickness: 0.016 inch sheet.
3. Finish: Embossed.
4. Joining: Longitudinal slip joints and 2 inch laps.
5. Fittings: 0.016 inch thick die-shaped fitting covers with factory-attached protective liner.

D. Reinforced Tape:

1. FSK tape suitable for sealing seams in insulation, insulated pipe bends, and fittings resulting in a tight, smooth surface without wrinkles.
2. Comply with UL 723 or ASTM E84.
3. Moisture Vapor Permeability: 0.00 perm inch, when tested in accordance with ASTM E96/E96M.
4. Finish: Match insulation.

E. Plain Foil Tape:

1. Aluminum foil with pressure-sensitive adhesive on paper release liner.
2. Finish: Plain foil.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Factory Insulated Equipment: Do not insulate.

C. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.

D. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor barrier cement.

E. Fiber glass insulated equipment containing fluids below ambient temperature; provide vapor barrier jackets, factory-applied or field-applied. Finish with glass cloth and vapor barrier adhesive.

F. For hot equipment containing fluids 140 degrees F or less, do not insulate flanges and unions, but bevel and seal ends of insulation.

G. For hot equipment containing fluids over 140 degrees F, insulate flanges and unions with removable sections and jackets.

H. Fiber glass insulated equipment containing fluids above ambient temperature; provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Finish with glass cloth and adhesive.

I. Finish insulation at supports, protrusions, and interruptions.

J. Cover glass fiber insulation with metal mesh and finish with heavy coat of insulating cement.

K. Nameplates and ASME Stamps: Bevel and seal insulation around; do not insulate over.

L. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation so it can be easily removed and replaced without damage.

3.02 SCHEDULE

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.

B. Heating Systems:

1. Pump Bodies: Mineral-Fiber Board: 2 inches thick and 3-lb/cu. ft. nominal density, with canvas and mastic.
2. Air Separators: Fiberglass Board: 2 inches thick, with canvas and mastic.
3. Expansion Tanks: Fiberglass Pipe and Tank: 1 inch thick.
4. Hot Thermal Storage Tanks: Fiberglass Board, 2” thick, with canvas and mastic.

END OF SECTION

SECTION 23 0719 - 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 07 8400 - Firestopping.

1.03 REFERENCE STANDARDS

A. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.
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; 2023.
D. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2022a.
E. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2023.
F. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2023).
G. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation; 2023.
H. ASTM C1423 - Standard Guide for Selecting Jacketing Materials for Thermal Insulation; 2021.
I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
J. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.
K. SAE AMS3779 - Tape, Adhesive, Pressure-Sensitive Thermal Radiation Resistant, Aluminum Coated Glass Cloth; 2016b.
L. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

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: www.certainteed.com/#sle.
2. Johns Manville Corporation: www.jm.com/#sle.
3. Knauf Insulation: www.knaufinsulation.com/#sle.
4. Owens Corning Corporation: www.ocbuildingspec.com/#sle.
5. Substitutions: See Section 23 0500 - HVAC General Provisions.

B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
1. K Value: ASTM C177, 0.24 at 75 degrees F.
2. Maximum Service Temperature: 850 degrees F.
3. Maximum Moisture Absorption: 0.2 percent by volume.

2.03 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturers:
1. Aeroflex USA: www.aeroflexusa.com/#sle.
2. Armacell LLC: www.armacell.us/#sle.
3. K-Flex USA LLC: www.kflexusa.com/#sle.
4. Substitutions: See Section 23 0500 - HVAC General Provisions.

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.
2. Maximum Service Temperature: 180 degrees F.
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 EXTRUDED POLYSTYRENE (XPS) BOARD INSULATION

A. Manufacturers:
1. Polyguard Products: www.polyguardproducts.com/#sle.
2. Owens Corning Corporation: www.ocbuildingspec.com/#sle.
3. Substitutions: See Section 23 0500 - HVAC General Provisions.

B. Comply with ASTM E84.

C. Insulation: ASTM C578; rigid closed cell.
1. K Value: 0.23 at 75 degrees F.
2. Maximum Service Temperature: 165 degrees F.
3. Maximum Water Vapor Permeance: 5.0 perm.

D. Billet Dimensions: 7 inches by 14 inches by 108 inches.

E. Density: Type X, 1.30 pcf (21 kg/cu m), minimum.

F. Water Absorption: Type X, 0.3 percent by volume, maximum, by total immersion.

2.05 JACKETING AND ACCESSORIES

A. PVC Plastic.
1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
a. Minimum Service Temperature: 0 degrees F.
b. Maximum Service Temperature: 150 degrees F.
c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.

d. Thickness: 10 mil, 0.010 inch.
e. Connections: Brush on welding adhesive.

B. Aluminum Jacket:
1. Comply with ASTM B209/B209M, Temper H14, minimum thickness of 0.016 inch with factory-applied polyethylene and kraft paper moisture barrier on the inside surface.
2. Thickness: 0.016 inch sheet.
3. Type: Factory-applied, self-adhesive jacketing.
4. Finish: Embossed.
5. Joining: Longitudinal slip joints and 2 inch laps.
6. Fittings: 0.016 inch thick die-shaped fitting covers with factory-attached protective liner.
7. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.
8. Metal Jacket Bands: 3/8 inch wide; 0.010 inch thick stainless steel.

C. Aluminum-Foil Laminate Jacket:
1. Factory-applied, pressure sensitive adhesive jacketing on paper release liner.
2. Finish: Aluminum embossed.
3. Comply with ASTM C1775.

D. Reinforced Tape:
1. FSK tape suitable for sealing seams between insulation, insulated pipe bends, and fittings resulting in a tight, smooth surface without wrinkles.
2. Comply with UL 723, ASTM E84.
3. Moisture Vapor Permeability: 0.00 perm inch, when tested in accordance with ASTM E96/E96M.

2.06 ACCESSORIES

A. General Requirements:
1. Provide required accessories in accordance with and subject to the recommendations of the insulation manufacturer.
2. Furnish compatible materials which do not contribute to corrosion, soften, or otherwise attack surfaces to which applied, in either the wet or dry state.
3. Comply with ASTM C795 requirements for materials to be used on stainless steel surfaces.
4. Supply materials that are asbestos free.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Stencil or label the outside insulation jacket of each union with the word "union."

C. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

D. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions at equipment.

E. 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.

F. Inserts and Shields:

1. Application: Piping 1-1/2 inches 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 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.

G. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions.
   1. At fire separations, terminate insulation at fire-rated wall and partition penetrations.

H. Fire-Barrier Penetration Protection:
   1. Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials.
   2. Provide intumescent collars, wraps, fire bands, sealants, and other firestopping materials as required to maintain the fire ratings for the piping and insulation materials used.
   3. Install Fire Stop Systems per the manufacturers guidelines.

I. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping. Provide two coats of UV-resistant finish for flexible elastomeric cellular insulation without jacketing.

J. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

K. 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 thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with polyester film.

3.02 SCHEDULE

A. Heating Systems:
   1. Heating Water Supply and Return: Fiberglass
      a. 1-1/4 inch diameter pipe and smaller: 1-1/2 inches thick, R-6 minimum.
      b. 1-1/2 inch pipe diameter and larger, 2 inches thick, R-8 minimum.

B. Cooling Systems:
   1. Refrigerant Suction: Flexible elastomeric, 1 inch thick.
   2. Refrigerant Hot Gas: Flexible elastomeric, 1 inch thick.

C. Outdoor, Aboveground:
   1. Jackets:
      a. Self-adhesive Outdoor Jacket.
      b. Aluminum.
      c. PVC.
   2. Heating-Hot-Water Supply and Return: Fiberglass: 2 inches thick, R-8 minimum.
   3. Refrigerant Suction and Hot-Gas Flexible Tubing:

a. Flexible Elastomeric: UV resistant, 1-1/2 inches thick.

END OF SECTION

SECTION 23 0913 - INSTRUMENTATION AND CONTROL DEVICES FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Control panels.

B. Control Valves:

1. Ball valves with factory-mounted actuators.
2. Butterfly valves with factory-mounted actuators.
3. Electronic valve operators.

C. Dampers.

D. Damper Operators:

1. Electric operators.

E. Humidistats:

1. Room humidistats.

F. Wall-, Surface-, and Duct-Mounted Sensors:

1. Temperature sensors.
2. Building static pressure transmitters.
3. Static air pressure sensors.
4. Airflow measuring devices.
5. Nitrogen dioxide sensors.
6. Carbon monoxide sensors.
7. Carbon dioxide sensors.

G. Thermostats:

1. Freezestats.
2. Room-mount thermostat accessories.

H. Fan and pump motor run-status monitoring.

I. Pipe-Mounted Sensors and Transmitters:

1. Temperature sensors.
2. Pressure transmitters.
3. Differential pressure transmitters.
4. Flow switches.

1.02 REFERENCE STANDARDS

A. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code); 1989 (Corrigendum 2019).

B. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

1.03 SUBMITTALS

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

B. Product Data: Provide description and engineering data for each control system component. Include sizing as requested. Provide data for each system component and software module.

C. Shop Drawings: Indicate complete operating data, system drawings, wiring diagrams, and written detailed operational description of sequences. Submit schedule of valves indicating size, flow, and pressure drop for each valve. For automatic dampers indicate arrangement, velocities, and static pressure drops for each system.

D. Operation and Maintenance Data: Include inspection period, cleaning methods, recommended cleaning materials, and calibration tolerances.

E. Project Record Documents: Record actual location of control components, including panels, thermostats, and sensors.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements for additional provisions.

PART 2 PRODUCTS

2.01 EQUIPMENT - GENERAL

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

2.02 CONTROL PANELS

A. Unitized cabinet type for each system under automatic control with relays and controls mounted in cabinet and temperature indicators, pressure gauges, pilot lights, push buttons and switches flush on cabinet panel face.

B. NEMA EN 10250, general purpose utility enclosures with enameled finished face panel.

C. Provide common keying for all panels.

2.03 CONTROL VALVES

A. Ball Valves with Factory-Mounted Actuators:

1. Service: Use for hot water.
2. Flow Characteristic: Include 2-way, 3-way diverting, and 3-way mixing operation configured to fail as indicated on drawings.
3. Body Size:
    a. Under 2-1/2 inches:
        1) Connection: NPT.
        2) Materials:
            (a) Body: Brass.
            (b) Flanges: Ductile iron.
            (c) Ball: Chrome-plated brass.
            (d) Stem: Nickel-plated brass.
            (e) Seat: Graphite-reinforced PTFE with EPDM O-Ring backing.
            (f) Stem Seal: EPDM O-Rings.
            (g) Flow Control Disk: Thermoplastic synthetic-resin.
    b. 2-1/2 inches and Above:
        1) Connection Type: Flanged.
        2) Materials:
            (a) Body: Brass.
            (b) Flanges: Ductile iron.
            (c) Ball: 300 series stainless steel.
            (d) Stem: 300 series stainless steel.
            (e) Seat: Graphite-reinforced PTFE with EPDM O-Ring backing.
            (f) Stem Seal: EPDM O-Rings.
            (g) Flow Control Disk: Thermoplastic synthetic-resin.
    c. Service Temperature:

1) Fluid Side: 0 to 284 degrees F liquid or 25 psig steam.
2) Ambient Side: From minus 40 to 131 degrees F.

4. Actuator Requirements:
   a. Assembly: Factory-mounted.
   b. Input: Configured for proportional control.
   c. Accessories: Provide with valve position indicator and manual override.

B. Butterfly Valves with Factory-Mount Actuators:
1. Iron body, bronze disc, resilient replaceable seat for service to 180 degrees F wafer or lug ends, extended neck.

C. Electronic Valve Actuators:
1. Valves shall spring return to normal position as indicated on freeze, fire, or temperature protection.
2. Select operator for full shut-off at maximum pump differential pressure.

2.04 DAMPERS

A. See Section 23 3300 for dampers and this section for actuators and operators.

2.05 DAMPER OPERATORS

A. General:
1. Provide actuators with torque capacity sized for minimum of 20 percent greater than maximum design stream velocity and hold tight seal against maximum system pressures.
2. Provide spring return for two position control and for fail safe operation.
3. Provide sufficient number of operators to achieve unrestricted movement throughout damper range.
4. Provide one operator for maximum 36 sq ft damper section.
5. Damper Position Indication: Electric switch type on two-position dampers to indicate fully open and fully closed. Provide where proof of position is required in sequence of operations.

B. Electric Operators:
1. Spring return, adjustable stroke motor having oil immersed gear train, with auxiliary end switch where reporti indicated in sequence of controls.

2.06 HUMIDISTATS

A. Room Humidistats:
1. Wall mounted, proportioning type.
2. Operating Range: 30 to 80 percent.
3. Maximum Temperature: ____ degrees F.
4. Cover: Set point indication.

2.07 WALL-, SURFACE-, AND DUCT-MOUNT SENSORS

A. Temperature Sensors:
1. Use thermistor or RTD type temperature sensing elements with characteristics resistant to moisture, vibration, and other conditions consistent with the application without affecting accuracy and life expectancy.
2. Performance Characteristics:
   a. RTD:
      1) Room Sensor Accuracy: Plus/minus 0.50 degrees F minimum.
      2) Duct Averaging Accuracy: Plus/minus 0.50 degrees F minimum.

3) Chilled Water Accuracy: Plus/minus 0.50 degrees F minimum.
4) All Other Accuracy: Plus/minus 0.75 degrees F minimum.
5) Range: Minus 40 degrees F through 220 degrees F minimum.

b. Thermistor:
1) Accuracy (All): Plus/minus 0.36 degrees F minimum.
2) Range: Minus 25 degrees F through 122 degrees F minimum.
3) Heat Dissipation Constant: 2.7 mW per degree C.

c. Sensing Range:
1) Provide limited range sensors if required to sense the range expected for a respective point.
2) Use RTD type sensors for extended ranges beyond minus 30 to 230 degrees F.
3) Use temperature transmitters in conjunction with RTDs when RTDs are incompatible with DDC controller direct temperature input.

3. Outside Air Sensors: Watertight inlet fitting shielded from direct rays of the sun.
4. Immersion Temperature Sensors: A sensor encased in a corrosion-resistant probe with an indoor junction box service entry body.
5. Room Temperature Sensors without Display:
a. Construct for wall box mounting.
b. Blank cover plate, labeled.
6. Room Temperature Sensors with Integral Digital Display:
a. Construct for surface or wall box.
b. Indication of space and outdoor temperatures.
c. Setpoint adjustment to accommodate room setpoint.
d. Display and control fan operation status.
e. Manual occupancy override and indication of occupancy status.
7. Temperature Averaging Elements:
a. Use on duct sensors for ductwork 10 sq ft or larger.
b. Use averaging elements where prone to stratification with sensor length 8 ft or 16 ft.
c. Provide for all mixed air and heating coil discharge sensors regardless of duct size.

B. Humidity Transmitters, Surface-Mounted:
1. Plastic housing encased, wall-mounted, humidity and temperature indicating sensor.
2. Humidity Sensor Type: Thin-film capacitive.
3. Accuracy: 1 percent at rated measuring scale and capable of withstanding 95 percent relative humidity without loss of calibration.
4. Output: Two-wire, 4 to 20 mA, 0 to 5 VDC or 0 to 10 VDC, non-loop powered, selectable.

C. Building Static Pressure Transmitters:
1. Single port for direct or tubing connection into wall or ceiling static pressure tip, direct acting, double bell, scale range 0.01 to 6.0 in-wc positive or negative, and sensitivity of 0.0005 in-wc. Transmit electronic signal to receiver with matching scale range.

D. Static-Air Pressure Sensors:
1. Unidirectional with ranges not exceeding 150 percent of maximum expected input.
2. Temperature compensate with typical thermal error or 0.06 percent of full scale in temperature range of 40 to 100 degrees F.
3. Accuracy: One percent of full scale with repeatability 0.3 percent.

E. Air Filter Switches: Differential pressure switches, automatic reset.

1. Provide appropriate scale range and differential adjustment for intended service.

F. Air Pressure Safety Switches: Manual reset with appropriate scale range and differential adjustment for intended service.

G. Airflow Measuring Devices: Capable of continuous measurement of air volume.
   1. Single or multiple airflow elements, factory mounted and pre-piped in casing designed for connection to ductwork. Multiple elements shall be manifolded together.
   2. Probes shall contain multiple total and static pressure sensors placed at concentric area centers along the exterior surface of the cylindrical probes and internally connected to their respective averaging manifolds.
   3. Traverse probes shall have symmetrical averaging signal takeoffs and shall be of aluminum construction with hard anodized finish with galvanized steel mounting hardware and shall not significantly impact fan performance or contribute to fan generated noise levels.
   4. Performance: +/- 5% of reading, calibrated for suitable air velocity.

H. Nitrogen Dioxide Sensors:
   1. Gas sensing module that holds fixed or replaceable nitrogen dioxide gas-sensor cartridge.
   2. Form Factor: IEC 60529, IP20 enclosure, single-gang electrical box mounted.
   3. Electromechanical sensor with 0 to 15 ppm measurement range.
   4. Accuracy: Plus/minus Five percent of range with 0.1 ppm resolution.
   5. Alarm: Auxiliary dry contact relay driven by setpoint adjustable between 1 to 180 ppm.

I. Carbon Monoxide Sensors:
   1. Gas sensing module that holds fixed or replaceable carbon monoxide gas-sensor cartridge.
   2. Form Factor: IEC 60529, IP20 enclosure, single-gang electrical box mounted.
   3. Electromechanical sensor with 0 to 500 ppm measurement range.
   4. Accuracy: Plus/minus Five percent of range with 1 ppm resolution.
   5. Alarm: Auxiliary dry contact relay driven by setpoint adjustable between 25 to 180 ppm.

J. Carbon Dioxide Sensors, Duct and Wall:
   1. General: Provide nondispersive infrared (NDIR), diffusion sampling CO2 sensors with integral transducers and linear output.
   2. Air Temperature: Range of 32 to 122 degrees F.
   3. Relative Humidity: Range of 0 to 95 percent (noncondensing).
   4. Calibration Characteristics:
      a. Automatically compensating algorithm for sensor drift due to sensor degradation.
      b. Maximum Drift: 2 percent.
      c. User calibratable with a minimum calibration interval of 5 years.
   5. Construction:
      a. Sensor Chamber: Noncorrosive material for neutral effect on carbon dioxide sample.
      b. Provide duct mounted sensors with duct probe designed to protect sensing element from dust accumulation and mechanical damage.
      c. Housing: High impact plastic.

2.08 THERMOSTATS

A. Low-Limit Temperature Cutout Switch: Manual reset, triggering on low temperature as sensed by any 18” maximum section.
   1. Configuration: Vapor-filled capillary.
   2. Probe Sensing Length: 1 foot long for each square foot of coil area.

3. Setpoint Adjust Control: Screw with manual reset switch.
4. Switch Type: SPDT, snap-action, form C in dust-protected enclosure.
5. Mounting: Locate on cooling coil intake side.

B. Room-Mounted Thermostat Accessories:
1. Thermostat Covers: Brushed aluminum.
2. Insulating Bases: For thermostats located on exterior walls.

2.09 FAN AND PUMP MOTOR RUN-STATUS MONITORING

A. Current Switches:
1. Mini Solid-Core: 2-State, On/Off digital output of motor status with adjustable trip point to detect belt loss or mechanical failure.
2. Solid Core: 2-state, On/Off digital output of motor status with adjustable trip point to detect belt loss or mechanical failure and built-in pilot duty relay.
3. Maximum AC Current Monitoring Value: As indicated on drawings.

B. Differential Pressure Switches:
1. Fan Status: Select for adjustable range suitable for application across fan discharge and external or fan inlet. Include static pressure tips.
2. Pump Status: Select for adjustable range suitable for application across pump discharge and suction sides. Include static pressure tips and 3-way valve manifold.

2.10 PIPE-MOUNTED SENSORS AND TRANSMITTERS

A. Temperature Sensors:
1. Pipe-mounted temperature probe tied to weather-resistant enclosure for direct insertion into compatible liquids or gases or inserted into intermediary thermal grease-filled pipe-well compatible with interfaced fluid.
2. Thermistor type with 24” lead; strap on to pipe under insulation.

B. Pressure Transmitters:
1. Self-contained transducer for monitoring of pneumatic, gas, liquid, or steam service with proportional range scaled over selected electronic output.
2. Service Monitoring Range: 0 to 15 psig.
3. Wetted Material: Brass for general service or stainless steel for steam and corrosive.
4. Stainless-steel diaphragm construction; minimum 150-psig operating pressure.

C. Differential Pressure Transmitters:
1. Stainless-steel diaphragm construction; minimum 150-psig operating pressure and tested to 300-psig.

D. Flow Switches:
1. Repetitive Accuracy: Plus/minus 10 percent of actual flow setting.
2. Switch Actuation: Adjustable over the operating range and sized for the application, such that the setpoint is between 25 and 75 percent of the full range.
3. Provide Form C snap-action contacts, rated for the application.
4. Furnish nonflexible paddle with magnetically actuated contacts, rated for service at a pressure greater than the installed conditions.

PART 3 EXECUTION

3.01 EXAMINATION

A. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Check and verify location of thermostats with plans and room details before installation. Locate 48 inches above floor. Align with lighting switches and humidistats; see Section 26 2726.

C. If any device, fixture, or panel is required to be wall mounted by this contractor, provide AC Plywood, 3/4” or 5/8” thickness, painted both sides with fireproof paint, color to be determined and coordinated with owner. Paint is required even if installed on a non-fire rated wall.

D. Mount freeze protection thermostats using flanges and element holders.

E. Mount outdoor reset thermostats and outdoor sensors indoors, with sensing elements outdoors out.

F. Provide separable sockets for liquids and flanges for air bulb elements.

G. Provide valves with position indicators and with pilot positioners where sequenced with other controls.

H. Provide mixing dampers of opposed blade construction arranged to mix streams. Provide pilot positioners on mixed air damper motors.

I. Install damper motors on outside of duct in warm areas. Do not install motors in locations at outdoor temperatures.

J. Install "hand/off/auto" selector switches to override automatic interlock controls when switch is in "hand" position.

K. Mount duct mount sensors in an electrical box through a hole in the duct and position to be easily accessible for repair or replacement.

L. Mount low temperature limit switches horizontally across duct in accordance with manufacturers recommended installation procedures. For large duct areas where the sensing element does not provide full coverage of the air stream, additional switches shall be provided as required to provide full protection of the air stream.Install averaging elements in ducts and plenums in crossing or zigzag pattern. Protect averaging or capillary tubes where they penetrate duct with rubber grommet and seal with clear silicon. Support with capillary clips and maintain minimum 1 inch tubing bending radius.

M. Differential pressure sensors used to control equipment such as fans and pumps shall be connected directly to the same controller that controls the equipment to ensure the continued proper operation of the controlled equipment without dependence on the control network.

N. Calibrate current switches to show a positive run status only when the motor is operating under load. A motor running with a broken belt or coupling shall indicate a negative run status.

O. Airflow Station: Install grid array in ductwork where shown. Provide gasket between frame and duct. Install in accordance with manufacturer’s instructions.

3.03 MECHANICAL ROOMS

A. Install boiler emergency switches near boiler room exit doors and where shown on the Drawings. Attach label.

B. Install carbon monoxide sensors in rooms containing gas fired boilers and gas fired water heaters.

3.04 CONTROL PANELS

A. Locations shown on the drawings are recommended locations and do not indicate actual quantity or location. Generally, locate all panels in mechanical and electrical rooms. Control panels will not be installed in public areas unless otherwise noted. Control panels will not be recessed installed on an exterior wall where condensation can accumulate in panel.

B. Mount control panels adjacent to associated equipment on vibration free walls or free-standing angle iron supports. One cabinet may accommodate more than one system in same equipment room. Provide engraved plastic nameplates for instruments and controls inside cabinet and engraved plastic nameplates on cabinet face.

C. All control devices located in exposed areas subject to outside weather conditions shall be mounted inside weatherproof enclosures. Location of each panel shall be convenient for adjustment service.

D. Engraved nameplates shall be provided beneath each panel face mounted control device describing the function of each device.

E. All electrical devices within the panel shall pre-wired to terminal strips with all inter-device wiring within the panel completed prior to installation of the system.

3.05 IDENTIFICATION

A. Major Equipment: Provide label with associated DDC point name. Major equipment includes all mechanical equipment scheduled on the Drawings.

B. Misc. Switches or Other Special Function Devices: Provide phenolic labels with indication of device function or as directed on the Drawings.

C. Roome Sensors: Provide label indicating equipment controlled by sensor.

3.06 ELECTRICAL WIRING AND CONNECTION INSTALLATION

A. Install raceways, boxes, and cabinets according to Division 26.

B. Install building wire and cable according to Division 26.

C. Install signal and communication cable according to Division 27.

D. All junction boxes, junction box covers and raceway systems except those embedded directly in earth or concrete, or surface metal raceway systems (wiremold), shall be externally identified by permanent bright blue paint suitable for the purpose, to easily distinguish from other communication or power raceway systems. Items shall be painted prior to installation. In addition to field painted conduit, factory painted conduit as manufactured by Allied Tube & Conduit (Data Com Blue Steel EMT), acceptable.

E. Provide conduit where cables are concealed in walls, in mechanical rooms, and in rooms without ceilings.

1. All control wiring in exposed, accessible or in inaccessible areas in Nursing Home, Patient Care and Hospital facilities, and Dormitories with an occupancy of 16 people or greater shall be run in conduit.

F. Bundle and harness exposed multiconductor instrument cable in place of single cables where several cables follow a common path.

G. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.

H. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.

I. Install wire and cable with sufficient slack and flexible connections to allow for vibration of piping and equipment.

J. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.

K. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

L. The Temperature Control Contractor shall provide any line voltage wiring required for local or central control panels. Power may be extended from the nearest receptacle circuit or spare circuit breaker in nearest normal power panel.

M. The Division 26 Contractor shall furnish all power wiring to electrical starters and motors.

3.07 SCHEDULES

A. Room Sensor Schdule:

1. Room Temperature Sensor, Blank Plate: Public areas such as corridors, toilet rooms.
2. Room Temperature Sensor, Display: Limited access areas such as classrooms, offices.
3. Humidity Sensor: Wash bay.

END OF SECTION

SECTION 23 0923 - DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. System description.
B. Operator interface.
C. Controllers.
D. Power supplies and line filtering.

1.02 RELATED REQUIREMENTS

A. Section 23 0913 - Instrumentation and Control Devices for HVAC.
B. Section 23 0993 - Sequence of Operations for HVAC Controls.

1.03 REFERENCE STANDARDS

A. MIL-STD-810 - Environmental Engineering Considerations and Laboratory Tests; 2022h, with Editorial Revision.
B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
C. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Product Data: Provide data for each system component and software module.
C. Shop Drawings:
    1. Indicate trunk cable schematic showing programmable control unit locations, and trunk data conductors.
    2. Show system configuration with peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.
    3. Indicate description and sequence of operation of operating, user, and application software.
    4. Damper schedule.
    5. Control valve schedule.
D. Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors.
    1. Revise shop drawings to reflect actual installation and operating sequences.
E. Operation and Maintenance Data:
    1. Include interconnection wiring diagrams complete field installed systems with identified and numbered, system components and devices.
    2. Include keyboard illustrations and step-by-step procedures indexed for each operator function.
    3. Include inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
F. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner s name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with NFPA 70.

B. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for purpose specified and indicated.

C. Contractors pre-approved to bid the work in this section:

1.06 SCOPE OF WORK

A. Furnish all labor, materials, equipment, and service necessary for a complete and operating Building Automation System (BAS), utilizing Direct Digital Controls (DDC) for energy management, equipment monitoring and control, and subsystems as defined in Project Documents. In general, all material and equipment used shall be standard components, regularly manufactured and available and not custom designed especially for this project.

1. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, accessories, and software connected to distributed controllers.
2. Patch holes in existing ductwork at removed sensors that are not reused, with sheet metal patches of equal gauge or heavier. Seal airtight with adhesive and then screwed or pop riveted to the ductwork.

B. Following divisions of work are generally applicable unless otherwise noted.

1. ATC contractor provides:
    a. All controllers, control devices, control panels, controller programming, controller programming software.
    b. Control components for terminal heating and cooling units not supplied with factory-wired controls.
    c. Software and programming of BAS, GUI, development of all graphical screens, setup of schedules, logs and alarms, network management, global supervisory control applications, system integration and coordination and connection of the NAC to the local or wide area network.
    d. BAS and Temperature Control wiring for a complete and operable system. All wiring shall be done in accordance with Division 26 of the specification and all local and national codes.
    e. Fire Alarm/Life Safety System. The DDC system shall monitor general alarm status of the fire alarm/life safety system via an alarmable point in the form of a dry contact. An addressable relay of the fire alarm system will be provided and terminated by Division 26, located next to the appropriate DDC panel. This Section will provide wiring from the relay to the DDC panel.
2. Products furnished by ATC contractor for installation by the Mechanical contractor:
    a. Control valves.
    b. Control dampers.
    c. Wells for hydronic temperature sensors.
    d. Static and differential pressure sensors for piping systems.
3. Products provided by Mechanical contractor:
    a. Balancing dampers.
    b. Smoke and smoke/fire dampers with actuators.
4. Electrical contractor provides, in accordance with Division 26 and Division 28:
    a. Providing motor starters and disconnect switches.
    b. Power wiring and conduit.
    c. Provision, installation and wiring of smoke detectors.

1.07 JOB CONDITIONS

A. Cooperation with Other Trades: Coordinate the Work of this section with that of other sections to insure that the Work will be carried out in an orderly fashion. It shall be this Contractor's responsibility to check the Contract Documents for possible conflicts between his Work and that of other crafts in equipment location, pipe, duct and conduit runs, electrical outlets and fixtures, air diffusers, and structural and architectural features.

1.08 WARRANTY

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

B. Correct defective Work within a two year period after Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Honeywell International, Inc: www.honeywell.com/#sle.

B. Johnson Controls, Inc: www.johnsoncontrols.com/#sle.

C. Schneider Electric: www.schneider-electric.us/#sle.

D. Substitutions: See Section 23 0500 - HVAC General Provisions.

2.02 SYSTEM DESCRIPTION

A. Automatic temperature control field monitoring and control system using field programmable micro-processor based units.

B. Base system on distributed system of fully intelligent, stand-alone controllers, operating in a multi-tasking, multi-user environment on token passing network, with central and remote hardware, software, and interconnecting wire and conduit.

C. Include computer software and hardware, operator input/output devices, control units, local area networks (LAN), sensors, control devices, actuators.

D. Controls for variable air volume terminals, radiation, reheat coils, unit heaters, fan coils, and the like when directly connected to the control units. Individual terminal unit control is specified in Section 23 0913.

E. Provide control systems consisting of thermostats, control valves, dampers and operators, indicating devices, interface equipment and other apparatus and accessories required to operate mechanical systems, and to perform functions specified.

F. System points lists included in the Documents are intended to show the desired alarm, monitoring, and control points. Add any control points necessary and as required to accomplish the sequence of operations.

G. Include installation and calibration, supervision, adjustments, and fine tuning necessary for complete and fully operational system.

H. Extend the existing DDC control system for HVAC to the new and remodeled areas.

1. Extension shall be seamless on the user interface. The existing graphics shall be upgraded or rebuilt so that the user interface has a uniform appearance between the new controls and the existing controls.
2. Upgrade the existing DDC control system for HVAC to the latest version supported by the existing equipment.

2.03 OPERATOR INTERFACE

A. Provide building operator interface accessible through facility LAN and remotely.

1. The building operator web interface shall be accessible via a web browser without requiring any "plug-ins" (i.e. JAVA Runtime Environment (JRE), Adobe Flash).

B. Provide a user interface with time-of-day schedules, data collection, dashboards, reports and building summary, system applications, and self-expiring timed overrides.

C. Provide a published user and applications guide(s) that detail the system application operation, configuration, setup and troubleshooting.

D. User Roles:
   1. The system shall include pre-defined "roles" that allow a system administrator to quickly assign permissions to a user.
   2. User logon/logoff attempts shall be recorded.

E. Online Help and Training
   1. Provide a context sensitive, on line help system to assist the operator in operation and configuration of the system.
   2. On-line help shall be available for all system functions and shall provide the relevant data for each particular screen.

F. System Graphics. Building operator web interface shall be graphically based and shall include at least one graphic per piece of equipment or occupied zone, graphics for each chilled water and hot water system.
   1. Animation: Graphics shall be able to animate by displaying different Image lies for changed object status.
   2. Alarm Indication: Indicate areas or equipment in an alarm condition using color or other visual indicator.

G. Manual Control and Override.
   1. Point Control. Provide a method for a user to view, override, and edit if applicable, the status of any object and property in the system.
   2. Temporary Overrides. The user shall be able to perform a temporary override wherever an override is allowed, automatically removing the override after a specified period of time.
   3. Override Owners. The system shall convey to the user the owner of each override for all priorities that an override exists.
   4. Provide a specific icon to show timed override or operator override, when a point, unit controller or application has been overridden manually.

H. Trend Logs:
   1. Prepare trend logs for all points required to show system calibration and stability.
   2. These logs shall document building operation after the installation, balancing and calibration is completed and after the control system is fully operational.

I. Scheduling: The scheduling application shall provide graphical representation of the day, week, month and exception events.
   1. Occupied Period: Period of time when building is in use and occupied. Coordinate with owner for normal occupied hours and days. Generally systems will be fully operational throughout this period and ventilation air shall be continuously introduced. Space temperature setpoints will generally be in the "normal" range of 69°-77°F.
   2. Unoccupied period: period of time when the building or zone is not in use and unoccupied. Ventilation air shall not be introduced.
   3. Setback Period: Setback will typically start with the end of the occupied period and end with the start of the preoccupancy period, however it shall be provided with its own schedule. Generally

systems will be off except to maintain a “setback” temperature, economization may be enabled to maintain “setback” cooling setpoint when applicable.

4. Warm-up Period: Time prior to the Occupied period when the systems are returning the space temperatures from setback to “normal” or occupied setpoints (warm-up and cool-down). Ventilation air shall not be introduced unless outside air conditions permit free-cooling. Time period shall be determined by an optimum start strategy unless otherwise specified.

J. Alarm/Event Notification

1. Alarm/Event Log. The operator shall be able to view all logged system alarms/events from any building operator web interface.
2. The operator shall be able to sort and filter alarms from events. Alarms shall be sorted in a minimum of 4 categories based on severity.
3. The operator shall be able to acknowledge and add comments to alarms
4. Alarm/event messages shall use full language, easily recognized descriptors.
5. Alerts: Include a paging feature with telephone/email alerts to selected personnel for critical alarms as defined by Owner.

K. Alarm Prioritization:

1. Level 1 Fault Alarm: Highest priority alarm. Unit shutdown until condition is gone and fault is manually cleared.
2. Level 2 Problem Alarm: Unit operation is modified to compensate and alarm automatically clears when the condition is gone.
3. Level 3 Warning Alarm: Lowest priority alarms. Alarm is indicated to alert operator of condition that needs attention.

2.04 CONTROLLERS

A. Building Controllers:

1. General:
   a. Manage global strategies by one or more, independent, standalone, microprocessor based controllers.
   b. Provide sufficient memory to support controller's operating system, database, and programming requirements.
   c. Share data between networked controllers.
   d. Controller operating system manages input and output communication signals allowing distributed controllers to share real and virtual object information and allowing for central monitoring and alarms.
   e. Utilize real-time clock for scheduling.
   f. Continuously check processor status and memory circuits for abnormal operation.
   g. Controller to assume predetermined failure mode and generate alarm notification upon detection of abnormal operation.
   h. Communication with other network devices to be based on assigned protocol.
2. Communication:
   a. Controller to reside on a BACnet network using ISO 8802-3 (ETHERNET) Data Link/Physical layer protocol.
   b. Perform routing when connected to a network of custom application and application specific controllers.
   c. Provide service communication port for connection to a portable operator's terminal or hand held device with compatible protocol.

3. Anticipated Environmental Ambient Conditions:
    a. Outdoors and/or in Wet Ambient Conditions:
        1) Mount within waterproof enclosures.
        2) Rated for operation at -40 to 150 degrees F.
    b. Conditioned Space:
        1) Mount within dustproof enclosures.
        2) Rated for operation at 32 to 120 degrees F.
4. Provisions for Serviceability:
    a. Diagnostic LEDs for power, communication, and processor.
    b. Make all wiring connections to field removable, modular terminal strips, or to a termination card connected by a ribbon cable.
5. Memory: In the event of a power loss, maintain all BIOS and programming information for a minimum of 72 hours.
6. Power and Noise Immunity:
    a. Maintain operation at 90 to 110 percent of nominal voltage rating.
    b. Perform orderly shutdown below 80 percent of nominal voltage.
    c. Operation protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W. at 3 feet.

B. Custom Application Controller:
1. General:
    a. Provide sufficient memory to support controller's operating system, database, and programming requirements.
    b. Share data between networked, microprocessor based controllers.
    c. Controller operating system manages input and output communication signals allowing distributed controllers to share real and virtual object information and allowing for central monitoring and alarms.
    d. Utilize real-time clock for scheduling.
    e. Continuously check processor status and memory circuits for abnormal operation.
    f. Controller to assume predetermined failure mode and generate alarm notification upon detection of abnormal operation.
    g. Communication with other network devices to be based on assigned protocol.
2. Communication:
    a. Controller to reside on a BACnet network using MS/TP Data Link/Physical layer protocol.
    b. Provide service communication port for connection to a portable operator's terminal or hand held device with compatible protocol.
3. Anticipated Environmental Ambient Conditions:
    a. Outdoors and/or in Wet Ambient Conditions:
        1) Mount within waterproof enclosures.
        2) Rated for operation at -40 to 150 degrees F.
    b. Conditioned Space:
        1) Mount within dustproof enclosures.
        2) Rated for operation at 32 to 120 degrees F.
4. Provisions for Serviceability:
    a. Diagnostic LED's for power, communication, and processor.
    b. Make all wiring connections to field removable, modular terminal strips, or to a termination card connected by a ribbon cable.

5. Memory: In the event of a power loss, maintain all BIOS and programming information for a minimum of 72 hours.
6. Power and Noise Immunity:
    a. Maintain operation at 90 to 110 percent of nominal voltage rating.
    b. Perform orderly shutdown below 80 percent of nominal voltage.
    c. Operation protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W. at 3 feet.

C. Application Specific Controllers:
1. General:
    a. Not fully user programmable, microprocessor based controllers dedicated to control specific equipment.
    b. Customized for operation within the confines of equipment served.
    c. Communication with other network devices to be based on assigned protocol.
2. Communication:
    a. Controller to reside on a BACnet network using MS/TP Data Link/Physical layer protocol.
    b. Provide service communication port for connection to a portable operator's terminal or hand held device with compatible protocol.
3. Anticipated Environmental Ambient Conditions:
    a. Outdoors and/or in Wet Ambient Conditions:
        1) Mount within waterproof enclosures.
        2) Rated for operation at -40 to 150 degrees F.
    b. Conditioned Space:
        1) Mount within dustproof enclosures.
        2) Rated for operation at 32 to 120 degrees F.
4. Provisions for Serviceability:
    a. Diagnostic LEDs for power, communication, and processor.
    b. Make all wiring connections to field removable, modular terminal strips, or to a termination card connected by a ribbon cable.
5. Memory: In the event of a power loss, maintain all BIOS and programming information for a minimum of 72 hours.
6. Power and Noise Immunity:
    a. Maintain operation at 90 to 110 percent of nominal voltage rating.
    b. Perform orderly shutdown below 80 percent of nominal voltage.
    c. Operation protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 3 feet.

D. Input/Output Interface:
1. Hardwired inputs and outputs tie into the DDC system through building, custom application, or application specific controllers.
2. All Input/Output Points:
    a. Protect controller from damage resulting from any point short-circuiting or grounding and from voltage up to 24 volts of any duration.
    b. Provide universal type for building and custom application controllers where input or output is software designated as either binary or analog type with appropriate properties.
3. Binary Inputs:
    a. Allow monitoring of On/Off signals from remote devices.

b. Provide wetting current of 12 mA minimum, compatible with commonly available control devices and protected against the effects of contact bounce and noise.
c. Sense dry contact closure with power provided only by the controller.

4. Pulse Accumulation Input Objects: Comply with all requirements of binary input objects and accept up to 10 pulses per second.
5. Analog Inputs:
   a. Allow for monitoring of low voltage 0 to 10 VDC, 4 to 20 mA current, or resistance signals (thermistor, RTD).
   b. Compatible with and field configurable to commonly available sensing devices.
6. Binary Outputs:
   a. Used for On/Off operation or a pulsed low-voltage signal for pulse width modulation control.
   b. Outputs provided with three position (On/Off/Auto) override switches.
   c. Status lights for building and custom application controllers to be selectable for normally open or normally closed operation.
7. Analog Outputs:
   a. Monitoring signal provides a 0 to 10 VDC or a 4 to 20 mA output signal for end device control.
   b. Provide status lights and two position (AUTO/MANUAL) switch for building and custom application controllers with manually adjustable potentiometer for manual override on building and custom application controllers.
   c. Drift to not exceed 0.4 percent of range per year.
8. Tri State Outputs:
   a. Coordinate two binary outputs to control three point, floating type, electronic actuators without feedback.
   b. Limit the use of three point, floating devices to the following zone and terminal unit control applications:
   c. Control algorithms run the zone actuator to one end of its stroke once every 24 hours for verification of operator tracking.
9. System Object Capacity:
   a. System size to be expandable to twice the number of input output objects required by providing additional controllers, including associated devices and wiring.
   b. Hardware additions or software revisions for the installed operator interfaces are not to be required for future, system expansions.

2.05 POWER SUPPLIES AND LINE FILTERING

A. Power Supplies:
1. Provide UL listed control transformers with Class 2 current limiting type or over-current protection in both primary and secondary circuits for Class 2 service as required by the NEC.
2. Limit connected loads to 80 percent of rated capacity.
3. Match DC power supply to current output and voltage requirements.
4. Unit to be full wave rectifier type with output ripple of 5.0 mV maximum peak to peak.
5. Regulation to be 1 percent combined line and load with 100 microsecond response time for 50 percent load changes.
6. Provide over-voltage and over-current protection to withstand a 150 percent current overload for 3 seconds minimum without trip-out or failure.
7. Operational Ambient Conditions: 32 to 120 degrees F.

8. EM/RF meets FCC Class B and VDE 0871 for Class B and MIL-STD-810 for shock and vibration.
9. Line voltage units UL recognized and CSA approved.

B. Power Line Filtering:
1. Provide external or internal transient voltage and surge suppression component for all workstations and controllers.
2. Minimum surge protection attributes:
a. Dielectric strength of 1000 volts minimum.
b. Response time of 10 nanoseconds or less.
c. Transverse mode noise attenuation of 65 dB or greater.
d. Common mode noise attenuation of 150 dB or greater at 40 to 100 Hz.

PART 3 EXECUTION

3.01 INSTALLERS

A. Installer List:
1. Johnson Controls, Inc..
2. Energy Tech Systems.
3. G&R Controls.
4. Substitutions: See Section 23 0500 - HVAC General Provisions.

3.02 INSTALLATION

A. Install control units and other hardware in position on permanent walls where not subject to excessive vibration.

B. Install software in control units and in operator work station. Implement all features of programs to specified requirements and appropriate to sequence of operation. Refer to Section 23 0993.

3.03 COORDINATION

A. Test and Balance Contractor
1. Furnish a single set of all tools necessary to interface to the control system for test and balance purposes.
2. Provide training in the use of these tools. This training will be planned for a duration of 4 hours.
3. Provide a qualified technician to assist in the test and balance process, until the first 20 terminal units are balanced.
4. The tools used during the test and balance process shall be returned to the ATC contractor at the completion of the testing and balancing.

3.04 ELECTRICAL WIRING AND CONNECTIONS

A. Install raceways, boxes, and cabinets according to Division 26.

B. Install building wire and cable according to Division 26.

C. Install signal and communication cable according to Division 27.

D. All junction boxes, junction box covers and raceway systems except those embedded directly in earth or concrete, or surface metal raceway systems (wiremold), shall be externally identified by permanent bright blue paint suitable for the purpose, to easily distinguish from other communication or power raceway systems. Items shall be painted prior to installation. In addition to field painted conduit, factory painted conduit as manufactured by Allied Tube & Conduit (Data Com Blue Steel EMT), acceptable.

E. Provide conduit where cables are concealed in walls, in mechanical rooms, and in rooms without ceilings.
   1. All control wiring in exposed, accessible or in inaccessible areas in Nursing Home, Patient Care and Hospital facilities, and Dormitories with an occupancy of 16 people or greater shall be run in conduit.

F. Bundle and harness exposed multiconductor instrument cable in place of single cables where several cables follow a common path.

G. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.

H. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.

I. Install wire and cable with sufficient slack and flexible connections to allow for vibration of piping and equipment.

J. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.

K. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

L. The Temperature Control Contractor shall provide any line voltage wiring required for local or central control panels. Power may be extended from the nearest receptacle circuit or spare circuit breaker in nearest normal power panel.

M. The Division 26 Contractor shall furnish all power wiring to electrical starters and motors.

3.05 CLEANING

A. At the completion of work in any area, the installation contractor shall clean all of their work, equipment, etc., making it free from dust, dirt and debris.

B. At the completion of work, all equipment furnished under this Section shall be checked for paint damage. Any factory finished paint that has been damaged shall be repaired to match the adjacent areas. Any metal cabinet or enclosure that has been deformed shall be replaced with new material and repainted to match the adjacent areas.

C. Remove all protective labels and coverings from room sensors.

3.06 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate complete and operating system to Owner.
   1. Upon project completion provide oral operating and maintenance instruction to the owner's representative for a minimum of 8 hours during normal working hours. The contractor shall assist the owner in videotaping the instruction if they choose to do so.
   2. Provide a brief description of the controls' sequence of operation.
   3. Provide a discussion and explanation of all alarms, switches and gauges.
   4. Provide a summary and explanation of steps to be taken in response to specific alarms or control malfunctions.
   5. Perform a building walk-through to physically locate and examine all control devices and demonstrate control setpoint adjustment procedures.
   6. Provide instructions regarding adjustment procedures shall emphasize methods for continual building "fine-tuning"

B. Demonstrate complete and proper operation of all systems per the Sequence of Operations to Engineer. The demonstration shall include, but not necessarily be limited to, the following:

1. Review of the trend logs.
2. Complete and proper operation of control systems including setpoints, valve positions, etc. shall be adjusted to artificially induce the sequences to occur.
3. Access to all devices for required maintenance.
4. Review of associated graphics on Host.
5. Identify and configure alarms.

C. Provide written operating and maintenance instruction including a copy of each of the above-mentioned submittals, inspection and calibration frequency and cleaning methods with recommended cleaning materials. Provide 2 copies to the Engineer in 3-ring binders.

D. Satisfactory completion is when all required training and testing to show performance compliance with the requirements of the Contract Documents has been performed to the satisfaction of the Engineer. System acceptance shall be contingent upon completion and review of all corrected deficiencies.

3.07 MAINTENANCE

A. Provide service and maintenance of energy management and control systems for one years from Date of Substantial Completion.

B. Provide two complete inspections, one in each season, to inspect, calibrate, and adjust controls as required, and submit written reports.

END OF SECTION

SECTION 23 0934 - VARIABLE-FREQUENCY MOTOR CONTROLLERS FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Variable-frequency motor controllers for low-voltage (600 V and less) AC motor applications.

B. Overcurrent protective devices for motor controllers, including overload relays.

1.02 RELATED REQUIREMENTS

A. Section 23 0529 - Hangers and Supports for HVAC Piping and Equipment.

B. Section 26 0526 - Grounding and Bonding for Electrical Systems.

1.03 REFERENCE STANDARDS

A. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code); 1989 (Corrigendum 2019).

B. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

C. NEMA IA 10030 - Industrial Control and Systems: Enclosures; 2024.

D. NEMA IS 10033 - Adjustable Speed Drives; 2020 (Reapproved 2025).

E. NEMA IS 10034 - Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable Speed Drive Systems; 2022 (Reapproved 2025).

F. NEMA ICS 7.2 - Application Guide for AC Adjustable Speed Drive Systems; 2021.

G. NEMA ICS 61800-2 - Adjustable Speed Electrical Power Drive Systems, Part 2: General Requirements-Rating Specifications for Low Voltage Adjustable Frequency AC Power Drive Systems; 2005.

H. NEMA MG 00001 - Motors and Generators; 2024.

I. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

J. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

K. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.

L. UL 61800-5-1 - Standard for Adjustable Speed Electrical Power Drive Systems - Part 5-1: Safety Requirements – Electrical, Thermal, and Energy (Ed. 2); Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate work to provide motor controllers suitable for use with actual motors to be installed.
2. Coordinate work to provide controllers and associated wiring suitable for interface with control devices to be installed.
3. Coordinate arrangement with dimensions and clearance requirements of actual equipment to be installed.
4. Verify with manufacturer that conductor terminations are suitable for use with conductors to be installed.
5. Notify Engineer of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

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

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for motor controllers, enclosures, overcurrent protective devices, and other installed components and accessories.

C. Shop Drawings: Indicate dimensions, voltage, controller sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

1. Include wiring diagrams showing factory and field connections.

D. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store in clean, dry space. Maintain factory wrapping or provide additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to internal components, enclosure, and finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. ABB: www.abb.com/#sle.

B. Danfoss: www.danfoss.com/#sle.

C. Cerus Industrial.

D. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

E. General Electric Company.

F. Rockwell Automation, Inc.; Allen-Bradley Brand.

G. Square D; a brand of Schneider Electric.

H. Toshiba International Corporation.

I. Substitutions: See Section 23 0500 - HVAC General Provisions .

J. Source Limitations: Furnish variable-frequency motor controllers and associated components produced by a single manufacturer and obtained from a single supplier.

2.02 VARIABLE-FREQUENCY MOTOR CONTROLLERS

A. Provide variable-frequency motor control system consisting of required controller assemblies, operator interfaces, control power transformers, instrumentation and control wiring, sensors, accessories, system programming, etc. as necessary for complete operating system.

B. Provide products listed, classified, and labeled as suitable for purpose intended.

C. Controller Assemblies: Comply with NEMA IS 10033, NEMA IS 10034, and NEMA ICS 61800-2; list and label as complying with UL 61800-5-1 or UL 508A as applicable.

D. Provide controllers selected for actual installed motors and coupled mechanical loads in accordance with NEMA ICS 7.2, NEMA MG 00001 Part 30, and recommendations of manufacturers of both controller and load, where not in conflict with specified requirements; considerations include, but are not limited to:

1. Motor type (e.g., induction, reluctance, and permanent magnet); consider NEMA MG 00001 design letter or inverter duty rating for induction motors.
2. Motor load type (e.g., constant torque, variable torque, and constant horsepower); consider duty cycle, impact loads, and high inertia loads.
3. Motor nameplate data.
4. Requirements for speed control range, speed regulation, and braking.

5. Motor suitability for bypass starting method, where applicable.

E. Devices on Load Side of Controller: Suitable for application across full controller output frequency range.

F. Operating Requirements:
   1. Input Voltage Tolerance: Plus/minus 10 percent of nominal.
   2. Input Frequency Tolerance: Plus/minus 5 percent of nominal.
   3. Efficiency: Minimum of 96 percent at full speed and load.
   4. Input Displacement Power Factor: Minimum of 0.96 throughout speed and load range.
   5. Overload Rating:
      a. Variable Torque Loads: Minimum of 110 percent of nominal for 60 seconds.
      b. Constant Torque Loads: Minimum of 150 percent of nominal for 60 seconds.

G. Power Conversion System: Microprocessor-based, pulse width modulation type.

H. Control System:
   1. Provide microprocessor-based control system for automatic control, monitoring, and protection of motors. Include sensors, wiring, and connections necessary for functions and status/alarm indications specified.
   2. Provide integral operator interface for controller programming, display of status/alarm indications, fault reset, and local control functions including motor run/stop, motor forward/reverse selection, motor speed increase/decrease, and local/remote control selection.
   3. Control Functions:
      a. Control Method: Selectable vector and scalar/volts per hertz unless otherwise indicated.
         1) Scalar/Volts per Hertz Control: Provide IR compensation for improved low-speed torque.
         2) Vector Control: Provide selectable autotuning function.
      b. Adjustable acceleration and deceleration time; linear and S-curve ramps; selectable coast to stop.
      c. Selectable braking control; DC injection or flux braking.
      d. Adjustable minimum/maximum speed limits.
      e. Adjustable pulse width modulation switching carrier frequency.
      f. Adjustable motor slip compensation.
      g. Selectable autorestart after noncritical fault; programmable number of time delay between restart attempts.
   4. Status Indications:
      a. Motor run/stop status.
      b. Motor forward/reverse status.
      c. Local/remote control status.
      d. Output voltage.
      e. Output current.
      f. Output frequency.
      g. DC bus voltage.
      h. Motor speed.
   5. Protective Functions/Alarm Indications:
      a. Overcurrent.
      b. Motor overload.
      c. Undervoltage.

d. Overvoltage.
e. Controller overtemperature.
f. Input/output phase loss.
g. Output short circuit protection.
h. Output ground fault protection.

6. Inputs, Outputs, Communications: Coordinate with ATC contractor.
7. Features:
   a. Password-protected security access.
   b. Event log.

I. Power Conditioning/Filtering:
1. Provide DC link choke or input/line reactor for each controller unless otherwise indicated or required.
   a. Total Harmonic Distortion: Not exceed 10%.
2. Reactor Impedance: 3 percent, unless otherwise indicated or required.

J. Packaged Controllers: Controllers factory-mounted in separate enclosure with externally operable disconnect and specified accessories.
1. Disconnects: Disconnect switch type.
   a. Provide externally operable handle with means for locking in OFF position. Provide safety interlock to prevent opening cover with disconnect in ON position with capability of overriding interlock for testing purposes.
   b. Provide auxiliary interlock for disconnection of external control power sources where applicable.
2. Provide door-mounted remote operator interface.

K. Service Conditions:
1. Provide controllers and associated components suitable for operation under following service conditions without derating:
   a. Altitude: Less than 3,300 feet.
   b. Ambient Temperature: Between 32 degrees F and 104 degrees F.
2. Provide controllers and associated components suitable for operation at indicated ratings under service conditions at installed location.

L. Conductor Terminations: Suitable for use with conductors to be installed.

M. Enclosures:
1. Comply with NEMA IA 10030.
2. NEMA EN 10250 Environment Type or Equivalent IEC 60529 Rating: Unless otherwise indicated, as specified for following installation locations:
   a. Indoor Clean, Dry Locations: Type 1 or Type 12.
   b. Outdoor Locations: Type 3R or Type 4.
   c. Hazardous/Classified Locations: Type 7/9, as required for classification of installed location.
3. Finish: Manufacturer's standard unless otherwise indicated.
4. Cooling: Forced air or natural convection as determined by manufacturer.
5. Enclosure Space Heaters:
   a. Provide in each controller enclosure installed outdoors and in unconditioned indoor spaces.
   b. Size according to manufacturer's recommendations for worst case ambient temperature to prevent condensation.
   c. Heater Control: Thermostat.

d. Heater Power Source: Provide connection to transformer factory-installed in enclosure or suitable external branch circuit as indicated or as required.

2.03 OVERCURRENT PROTECTIVE DEVICES

A. By others.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.
B. Install in accordance with NEMA IS 10034 and manufacturer's instructions.
C. Do not exceed manufacturer's recommended maximum cable length between controller and motor.
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 23 0529.
F. Install controllers plumb and level.
G. Provide grounding and bonding in accordance with Section 26 0526.
H. Install field-installed devices, components, and accessories.
I. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
J. Set field-adjustable settings of controllers and associated components according to installed motor requirements, in accordance with recommendations of manufacturers of controller and load.

3.02 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.
B. Perform inspections and tests listed in NETA ATS, Section 7.17. Insulation-resistance test on control wiring listed as optional is not required.
C. Correct deficiencies and replace damaged or defective controllers or associated components.

3.03 CLOSEOUT ACTIVITIES

A. Training: Train Owner's personnel on operation, adjustment, and maintenance of controllers and associated devices.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

3.04 PROTECTION

A. Protect installed controllers from subsequent construction operations.

END OF SECTION

SECTION 23 0993 - SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section defines the manner and method by which controls function. Requirements for each type of control system operation are specified. Equipment, devices, and system components required for control systems are specified in other sections.

1.02 RELATED REQUIREMENTS

A. Section 23 0913 - Instrumentation and Control Devices for HVAC.

B. Section 23 0923 - Direct-Digital Control System for HVAC.

1.03 SUBMITTALS

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

B. Sequence of Operation Documentation: Submit written sequence of operation for entire HVAC system and each piece of equipment.

1. State each sequence in small segments and give each segment a unique number for referencing in Functional Test procedures; provide a complete description regardless of the completeness and clarity of the sequences specified in Contract Documents.
2. Include initial and recommended values for all adjustable settings, setpoints and parameters that are typically set or adjusted by operating staff; and any other control settings or fixed values, delays, etc. that will be useful during testing and operating the equipment.
3. For packaged controlled equipment, include manufacturer's furnished sequence of operation amplified as required to describe the relationship between the packaged controls and the control system, indicating which points are adjustable control points and which points are only monitored.

C. Control System Diagrams: Submit graphic schematic of the control system showing each control component and each component controlled, monitored, or enabled.

D. Points List: Submit list of all control points indicating at least the following for each point.

1. Name of controlled system.
2. Point abbreviation.
3. Point description; such as dry bulb temperature, airflow, etc.
4. Display unit.

E. Project Record Documents: Record actual locations of components and setpoints of controls, including changes to sequences made after submission of shop drawings.

1.04 ALARM NOMENCLATURE

A. Level 1 Fault Alarm: Highest priority alarm. Unit shutdown until condition is gone and fault is manually cleared.

B. Level 2 Problem Alarm: Unit operation is modified to compensate and alarm automatically clears when the condition is gone.

C. Level 3 Warning Alarm: Lowest priority alarms. Alarm is indicated to alert operator of condition that needs attention.

D. Binary Alarm: General alarm when alarm signal is received from equipment controller.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 AIR HANDLER

A. AH-1: constant volume air handler with supply fan, pre-filter and filter stations. Unit provides requried airflow and filtration for gun range.
   1. Supply fan:
      a. Run fan continousuly during occupied hours. Provide physical on/off control with lighted switches for user activation.
   2. Filters: Measure differential pressure over filters and alarm on pressure increase.

B. Display: For each air handler:
   1. Actual temperatures for supply air.
   2. Occupied status.
   3. Supply fan status.
   4. Return fan status and speed.
   5. DX cooling stages or percent capacity.
   6. Energy wheel status.
   7. Filters Normal/Dirty status.
   8. Alarms.
      a. Level 2: Supply fan fail.
      b. Level 2: Supply air temperature 10 degree F from setpoint.
      c. Level 3: Supply or return fan in Hand operation.
      d. Level 3: Dirty filters.
   9. BAS system graphic.

3.02 AIR TERMINAL UNITS (VAV'S)

A. Single-duct, Variable Volume:
   1. Cooling Only:
      a. On a rise in space temperature, the damper will modulate to provide maximum airflow.
      b. As space temperature decreases, the damper will modulate down to its minimum airflow.
   2. Cooling with Reheat:
      a. On a rise in space temperature above the cooling set-point, the unit modulates to its maximum airflow.
      b. As the space temperature falls below the cooling set-point, the unit modulates to its minimum airflow.
      c. As the space temperature continues to fall to the heating set-point, the terminal modulates to its heating minimum airflow. At this point, the heat will be staged on as follows:
         1) Heating valve shall open to meet heating discharge air setpoint.
         2) Unit shall modulate to its heating maximum airflow while maintaining heating discharge air setpoint.

B. Display:
   1. Zone temperature: actual and set point.
   2. Discharge air temperature: actual and set point.
   3. Airflow: actual and setpoint.
   4. Occupied status.

5. Control-valve positions as percent open.
6. Damper positions as percent open.
7. Alarms.
    a. Level 2: Zone temperature 5°F outside of setpoint.
8. BAS system graphic.

3.03 BOILERS

A. Description: Hydronic boilers with factory controls; boiler circulator pumps. Water temperature setpoints set by ATC.
    1. Boiler controller shall make all decisions for modulating boiler heating output, cascading boilers, and operating boiler circulators.
    2. Provide communication wiring between boiler controllers.
    3. Provide low voltage wiring between boiler controllers and factory provided sensors as required.
    4. Provide wiring between boiler controller and boiler circulator pumps.
    5. Provide boiler emergency kill switch at each boiler room exit.
    6. Provide CO detector near primary boiler room exit.
    7. Monitor low water level alarm.

B. Heating supply water termperature reset:
    1. Adjust heating water setpoint at maximum 185 degrees F at outdoor temperature of 0 degrees F, and minimum 120 degrees F at outdoor temperature of 45 degrees F, with straight line relationship between.

C. Display:
    1. Outside air temperature.
    2. System hot water supply temperature: actual and setpoint.
    3. Sysetm hot water return temperature.
    4. Boiler inlet and outlet temperatures per Drawings.
    5. Boiler operation: command and proof.
    6. Boiler circulator pump: command and proof.
    7. CO levels.
    8. Alarms.
        a. Binary: Boiler lockout.
        b. Level 1: Emergency stop activated. Shut down boilers.
        c. Level 1: Low water level alarm. Shut down boilers.
        d. Level 2: Bulding power failure.
        e. Level 2: CO levels above 100 ppm.
        f. Level 2: Heating supply water 15 degrees F below setpoint.
        g. Level 2: Boiler circulator fail.
    9. BAS system graphics.

3.04 CABINET HEATERS

A. Hydronic heat:
    1. Cycle fan and open control valve to maintain zone temperature.

B. Display:
    1. Zone temp: actual and set point.
    2. Control valve position.
    3. Fan operation status.

4. Alarms.
    a. Level 2: Zone temperature 5 degrees F from setpoint.
5. BAS system graphic.

3.05 ENERGY RECOVERY UNIT

A. Description: Unit is air-to-air energy recovery with supply fan and exhaust fan. Energy recovery unit shall be equipped with factory controls and low voltage terminal strip.

B. Supply and Exhaust Fan:
    1. Office areas: Run fans continously during occupied hours.
    2. Shop areas: Run fans continously.

C. Dampers: Open intake and exhaust dampers when fans are running.

D. Display:
    1. Temperatures: supply air, return air, exhaust air, outside air.
    2. Fan command and verification.
    3. Filter pressure drop.
    4. Alarms:
        a. Level 2: Fans not proven.
        b. Level 3: Filters dirty.
    5. BAS system graphic.

3.06 FANS

A. Toilet room exhaust:
    1. Run when toilet room lights are on, stop when toilet room lights are off.

B. CO Gas Control: Start fan(s) and open damper(s) when CO is above 50 PPM.
    1. Applicable equipment: Shop fans and gravity ventilators.

C. NO2 Gas Control: Start fan(s) and open damper(s) when CO is above 5 PPM.
    1. Applicable equipment: Shop fans and gravity ventilators.

D. Humidity Control: Start fan(s) and start MAU when relative humidity is above 60%.
    1. Applicable equipment: Wash bay exhaust fan.
    2. Related sequence: Make-Up Air Units paragraph.

E. Display:
    1. CO levels in PPM.
    2. NO2 levels in PPM.
    3. Zone relative humidity level in percentage.
    4. Fan(s) status and speed as applicable.
    5. Damper(s) positions.
    6. Alarms.
        a. Level 1: CO above 35 PPM
        b. Level 1: NO2 above 2 PPM
        c. Level 1: Humidity 10% above setpoint.
        d. Level 2: CO above 100 PPM.
        e. Level 2: NO2 above 6 PPM.
        f. Level 2: Fan fail to run.
    7. BAS system graphic.

3.07 FAN COIL UNITS

A. Heating onlyunits:
   1. Supply fan:
      a. Variable volume: Increase fan speed as zone temperature rises above cooling setpoint or falls below heating setpoint.
      b. Constant volume: Cycle fan as zone temperature rises above cooling setpoint or falls below heating setpoint.
      c. Fan on continously during occupied hours and cycle on during unoccupied hours.
   2. Hydronic heating coil: Modulate control valve to maintain space air temperature setpoint.

B. Display:
   1. Zone temperature: actual and set point.
   2. Discharge air temperature: actual and set point.
   3. Control-valve positions as percent open.
   4. Fan operation status.
   5. Alarms:
      a. Level 2: Zone temp 5°F below setpoint.
   6. BAS system graphic.

3.08 HEAT TRACE CABLE

A. Rain leader heat trace: Factory controller.
   1. Obtain ambient temperature setpoints from manufacturer for heat trace activation.
   2. Monitor outdoor air temperature and heat trace operation.

B. Display:
   1. Outdoor air temperature.
   2. Heat trace activation setpoint.
   3. Alarm:
      a. Level 1: Outdoor air temperature is 5 degrees F beyond setpoint and heat trace is not active.
   4. BAS system graphic.

3.09 HEATING COILS

A. Hydronic heating coils: Open control valve to maintain zone heating temperature setpoint. Provide night setback.

B. Display:
   1. Zone temperature: actual and set point.
   2. Discharge air temperature: actual and set point.
   3. Control-valve positions as percent open.
   4. Alarms:
      a. Level 2: Zone temperature 5°F below setpoint.
      b. Level 2: Discharge temperature 10°F below setpoint.
   5. BAS system graphic.

3.10 HYDRONIC WATER SYSTEM

A. Monitor system pressure at system expansion tank.

B. Provide command to open all control valves in system to facilitate test and balance procedure.

C. Display:
   1. System pressure.

2. Valve position override status.
3. Alarms:
    a. Level 1: System pressure below 1 psi. Shut down boilers, chillers, pumps, and heat pumps as applicable.
    b. Level 2: System pressure below 5 psi.
4. BAS system graphic.

3.11 IR TUBULAR HEATERS

A. Wall-mounted temperature sensor maintains constant space temperature by activating gas-fired burner.
    1. Stage heating for multi-stage units.
B. Display:
    1. Zone temperature: actual and set point.
    2. Burner operation status.
    3. Alarms:
        a. Level 2: Zone temp 5°F below setpoint.
    4. BAS system graphic.

3.12 MAKE-UP AIR UNITS

A. Constant Volume, 100% outside air: MAU-1
    1. Supply Fan: Start when exhaust fan(s) are active.
        a. Applicable fans: Wash bay exhaust fan.
    2. Furnace: Modualte to maintain discharge air setpoint.
B. Display: For each MAU as applicable.
    1. Fan status and speed.
    2. Furance status and output
    3. Damper positions.
    4. Dirty filter status.
    5. Alarms
        a. Level 1: Discharge air temperature below freezing. Shut down unit.
        b. Level 2: Discharge air temperature 10 degrees F below setpoint.
        c. Level 2: Fan or furnace fail.
        d. Level 3: Dirty filters.
    6. BAS system graphic.

3.13 PUMPS

A. Hot water system pumps: Lead/lag operation, variable speed.
    1. Equipment: P-1, P-2 under base bid; P-3 under alternate bid.
        a. Provide VFD's for each pump.
    2. Set VFD maximum/minimum speeds based on test and balance results.
    3. Alterante lead/lag pump on monthly basis or when lead pump fails.
    4. Cascade pumps and modulate pump speed to maintain differential pressure setpoint.
        a. Locate differential pressure sensor where hydronic piping enters garage area from office.
B. Domestic hot water recirculation pump: constant speed.
    1. Activate pump to maintain recirculation temperature of 120 degrees F.
        a. Applicable equipment: P-10
    2. Lock out pump during unoccupied hours.

C. Display: For each set of pumps.
    1. Outside air temperature.
    2. Domestic hot water recirculation temperature.
    3. Lead/Lag status.
    4. Pump proven flow status.
    5. Pump speed as percentage of minimum/maximum speed set by test and balance.
    6. Differential pressure: actual and setpoint.
    7. Alarms.
        a. Level 1: System pressure below 3 psi.
            1) Shut down pumps and equipment served by system as required to prevent equipment damage.
        b. Level 2: Pump not proven on.
        c. Level 2: Heat pump system temperature 10 degrees F outside temperature range.
        d. Level 3: Differential pressure 5 psi from setpoint.
        e. Level 3: Domestic hot water pump runtime greater than 2 hours.
    8. BAS system graphic.

3.14 RADIANT FLOOR HEATING

A. System consists of hydronic manifold, circulation pump, and control valve.
    1. Floor heating is under alternate bid.
    2. Provide floor temperature sensor installed in conduit.
B. Pump: Start pump to maintain zone temperature setpoint.
    1. Limit concrete temperature to maximum of 85 degrees F.
C. Control valve: Modulate to maintain supply water temperature to maximum of 120 degrees F.
D. Display:
    1. Concrete temperature.
    2. Zone temperature.
    3. Control valve position as percent open.
    4. Pump command status.
    5. HWS temperatures.
    6. Alarms:
        a. Level 2: Zone temp 10°F below setpoint.
    7. BAS system graphic.

3.15 RADIATION AND CONVECTORS

A. Heating unit: Open control valve to maintain zone heating temperature.
    1. Close valve if zone goes into cooling mode.
B. Display:
    1. Zone temperature: actual and set point.
    2. Control-valve positions as percent open.
    3. Alarms:
        a. Level 2: Zone temp 5°F below setpoint.
    4. BAS system graphic.

3.16 ROOFTOP UNITS, OFFICE

A. Description: Packaged rooftop air conditioner with heat wheel, economizer, supply and exhaust fan.

B. Duct static pressure setpoint reset: Adjust at a frequency of once every 5 minutes.
    1. Set maximum duct static based on Drawings schedule.
    2. Decrease duct static pressure setpoint so that the VAV damper with the greatest demand is not less than 80% open.
    3. Increase duct static pressure setpoint if any VAV damper is at 100% open.
C. Supply air temperature setpoint reset:
    1. Normal operation during occupied hours: Set to 55 degrees F.
    2. Linearly increase setpoint as return air temperature drops below 75 degrees F.
D. Supply fan:
    1. Run fan continousuly during occupied hours.
    2. Modulate fan to maintain duct static pressure setpoint.
    3. Shut off fan on high static pressure alarm.
E. Exhaust fan: Run and modulate speed to match supply fan airflow.
F. Energy wheel:
    1. Normal operation: run wheel when supply fan is running.
    2. Outside temperature between 50 degree F and 70 degree F: stop wheel.
    3. Measure differential pressure over wheel.
G. Bypass damper: wheel frost control.
    1. When outside air temperatures are below 5 degrees F and the differential pressure over the wheel increases: Modulate damper to keep exhaust air temperature above 25 degrees F.
H. Cooling coil, DX: Modulate or stage condensing unit to maintain discharge air temperature setpoint.
    1. Lock out cooling when outside air temperature is below 55 degrees F.
I. Mixing box:
    1. Unoccupied hours: Set return damper to 100% open and outside air damper to 0% open.
    2. Occupied hours: Open outside air damper to minimum position set by test and balance for ventilation.
    3. Economizer mode: When outside air is below 55 degrees F, modulate return and outside air dampers to deliver 55 degree F supply air.
        a. Lock out mechanical cooling during economizer mode.
    4. Freeze Protection: If freezing temperatures are detected, close outside air damper and full open return air damper.
J. Filters: Measure differential pressure over filters and alarm on pressure increase.
K. Display:
    1. Occupied/unoccupied mode.
    2. Ventilation status.
    3. Actual temperatures for supply air.
    4. Setpoint temperatures for supply air.
    5. Duct pressure setpoint and actual.
    6. Supply fan status and speed.
    7. Return fan status and speed.
    8. DX cooling stages or percent capacity.
    9. Energy wheel status.
    10. Damper positions as percent open.
    11. Filters Normal/Dirty status.

12. Critical zone VAV for pressure zone optimization.
13. Alarm.
    a. Level 1: Discharge temperature is below 35°F. Shut down unit.
    b. Binary: VFD fault.
    c. Binary: Alarms from air handler controller.
    d. Level 1: High static pressure trip.
    e. Level 2: Freezestat trip.
    f. Level 2: Supply fan fail.
    g. Level 2: Return fan fail.
    h. Level 2: Supply air temperature 10 degree F from setpoint.
    i. Level 3: Supply or return fan in Hand operation.
    j. Level 3: Dirty filters.
    k. Level 3: Energy wheel frosted over.
14. BAS graphic.

3.17 ROOFTOP UNITS, FIRING RANGE

A. Description: Packaged rooftop air conditioner with heating. Unit supplies fresh air to firing range air handler. System includes:
    1. Reheat coil in ductwork.
    2. Exhaust fan mounted on roof.
B. Supply air temperature setpoint:
    1. Adjust RTU temperature setpoint to maintain a supply temperature of 70 degrees F at the firing range air handler.
C. Supply fan:
    1. Run fan continousuly when firing range is occupied. Provide physical on/off control with lighted switches for user activation.
D. Exhaust fan:
    1. Run fan when RTU supply fan is running.
E. Cooling coil, DX: Modulate or stage condensing unit to maintain discharge air temperature setpoint.
    1. Lock out cooling when outside air temperature is below 55 degrees F.
F. Gas furance: Stage furnace to maintain discharge air temperature setpoint.
G. Filters: Measure differential pressure over filters and alarm on pressure increase.
H. Display:
    1. Occupied/unoccupied mode.
    2. Actual temperatures for supply air.
    3. Setpoint temperatures for supply air.
    4. Supply fan status.
    5. Exhaust fan status.
    6. DX cooling stages or percent capacity.
    7. Furnace stages active.
    8. Filters Normal/Dirty status.
    9. Alarm.
        a. Level 2: Supply fan fail.
        b. Level 2: Exhaust fan fail.
        c. Level 2: Supply air temperature 10 degree F from setpoint.

d. Level 3: Supply or return fan in Hand operation.
e. Level 3: Dirty filters.

10. BAS graphic.

3.18 SUMP PUMP

A. Description: Sump pump with factory controls.
B. Provide proof of flow on sump pumps.
C. Monitor sump pump controller high water alarm.
D. Display:
    1. Realtime meter of pump run/down time in hours.
    2. Pump run time of last start/stop cycle, in hours.
    3. Pump downtime time from last start/stop cycle in hours.
    4. Alarms:
        a. Level 2: High water alarm.
        b. Level 2: Pump fail.
    5. BAS system graphic.

3.19 TEMPERATURE MONITORING

A. Electrical room, upper level:
    1. Monitor Split AC unit alarm and monitor condensate overflow.
    2. Monitor room temperature. Activate alarm if temperature rises above 85 degrees F.
B. Display:
    1. Room temperature.
    2. Alarm:
        a. Level 2: Temperature above setpoint.
        b. Level 2: Condensate overflow.
    3. BAS system graphic.

3.20 UNIT HEATERS

A. Gas-fired heat exchanger with single speed fan: Start fan and activate furance on call for heat.
B. Display:
    1. Zone temperature: actual and set point.
    2. Control-valve positions as percent open.
    3. Fan operation status.
    4. Alarms:
        a. Level 2: Zone temp 5°F below setpoint.
    5. BAS system graphic.

END OF SECTION

SECTION 23 1100 - FACILITY LIQUEFIED-PETROLEUM SUPPLY STATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pressure regulators.

B. Storage containers.

C. Vaporizers.

1.02 RELATED REQUIREMENTS

A. Section 23 1126 - Facility Liquefied-Petroleum Gas Piping .

1.03 AUTHORITIES AND AGENCIES

A. Obtain and pay all permits, inspections, licenses and other charges for large above ground tanks as required by the State Fire Marshal. Upon completion of the Work, furnish proof of acceptance by proper agency having jurisdiction.

1.04 SUBMITTALS

A. Shop Drawings: For equipment covered under this section as per Section 230500.

1. Product Data: For each type of the following:

a. Pressure regulators. Indicate pressure ratings and capacities.

b. Storage containers.

c. Vaporizers.

B. Operation and Maintenance Manuals: For equipment covered under this section as per Section 230500.

1.05 QUALITY ASSURANCE

A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 2 PRODUCTS

2.01 PRESSURE REGULATORS

A. Description: Designed to reduce LP gas container pressures to between 3 and 125 PSIG.

B. Manufacturers:

1. RegO Products.

2. Fisher; Emerson Electric Company.

3. Marshall Excelsior Company.

4. Substitutions: See Section 23 0500 - HVAC General Provisions.

C. Materials:

1. Body and Bonnet: Corrosion resistant metal.

2. Nozzle Orifice: Brass.

3. Spring: Steel.

4. Valve Seat Discs: Resilient rubber.

5. Diaphragms: Integrated fabric and synthetic rubber.

D. Overpressure Protection Device: Factory mounted on pressure regulator.

E. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.

2.02 STORAGE CONTAINERS

A. Description: Factory fabricated, complying with requirements in NFPA 58 and ASME Boiler and Pressure Vessel Code and bearing the ASME label. Tanks shall be rated for 250-psig minimum working pressure.

B. Manufacturers:
   1. American Welding and Tank Co.
   2. Trinity Industries, Inc.
   3. Quality Steel Corporation
   4. TransTech Energy, LLC
   5. Ransome Manufacturing
   6. Substitutions: See Section 23 0500 - HVAC General Provisions.

C. Accessories: Provide all required including pressure relief devices, shutoff valves, check valves, internal valves, and pressure gauges.

D. Exposed Metal Surfaces, Outdoor Installation: Mechanically cleaned, primed, and painted for resistance to corrosion.

E. Stainless-Steel Nameplate: Attach to aboveground storage container or to adjacent structure for underground storage container.

2.03 VAPORIZERS

A. Description: Factory-fabricated, -assembled, and -tested vaporizer with heat exchanger sealed pressure-tight, built on a steel base; including insulated jacket, flue-gas vent, liquid fuel supply and vapor connections, and controls. Assembly shall be FMG labeled and comply with NFPA 58 and NFPA 70.

B. Manufacturers:
   1. Algas SDI; Torrexx.
   2. Ransome Manufacturing; RE Series.
   3. Substitutions: See Section 23 0500 - HVAC General Provisions.

C. Casing:
   1. Mineral-fiber insulation, a minimum of 2 inches (50 mm) thick, surrounding the heat exchanger.
   2. Sheet metal jacket with screw-fastened closures and baked-enamel or powder-coat protective finish.
   3. Mounting base to secure boiler to concrete base.
   4. Control Compartment Enclosure: NEMA 250, Type 4, enclosure housing control panels for LPG-fired vaporizers. Explosion-proof control compartment construction required for electric vaporizers.

D. LPG Liquid and Vapor Circuit Specialties:
   1. Vaporizer coil safety pressure relief valve.
   2. Vapor outlet isolation valve.
   3. Inlet safety solenoid valve to close with off-normal operation alarm.
   4. Liquid carryover or float-type safety shutoff switch.

PART 3 EXECUTION

3.01 STORAGE CONTAINER INSTALLATION

A. Install piping connections with swing joints or flexible connectors to allow for storage container settlement and for thermal expansion and contraction.

B. Ground containers according to NFPA 780.

C. Underground Tanks:

1. Set concrete saddles on dowels set in concrete base. Anchor steel saddles to concrete base.
2. Set storage container on concrete ballast base large enough to offset buoyancy of empty storage container immersed in water.
3. Install tie-down straps over container anchored in ballast base and repair damaged coating.
4. Backfill with a minimum coverage for underground or mounded storage containers according to NFPA 58. Backfill with pea gravel.
5. Install cathodic protection for storage container.

3.02 VAPORIZER INSTALLATION

A. Install vaporizer with access space for periodic maintenance.

B. Set vaporizers on and anchor to concrete base.

C. Connect liquid line from pump set, and vapor supply to distribution piping.

D. Install backup connection from vapor space of container to inlet of pressure-regulating valve at vaporizer discharge to bypass the vaporizer during maintenance. Install shutoff valves to change source from vaporizer to storage container.

3.03 FIELD QUALITY CONTROL

A. Test, inspect, and purge LPG according to NFPA 58 and NFPA 54 and requirements of authorities having jurisdiction.

B. LPG piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION

SECTION 23 1126 - FACILITY LIQUEFIED-PETROLEUM GAS PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe, pipe fittings, valves, and connections for propane gas piping systems.

1.02 REFERENCE STANDARDS

A. ANSI LC 1/CSA 6.26 - Fuel Gas Piping Systems Using Corrugated Stainless Steel Tubing; 2023.
B. ANSI Z21.18/CSA 6.3 - Gas Appliance Pressure Regulators; 2019.
C. ANSI Z21.80/CSA 6.22 - Line Pressure Regulators; 2019.
D. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2021.
E. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.
F. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.
G. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes; 2024.
H. ASME B31.1 - Power Piping; 2024.
I. ASME B31.9 - Building Services Piping; 2020.
J. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2024.
K. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.
L. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2024.
M. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.
N. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2020.
O. ASTM D2513 - Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings; 2024, with Editorial Revision (2025).
P. ASTM D2683 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing; 2020.
Q. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
R. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2019.
S. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements; 2018, with Editorial Revision (2020).
T. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry; 2018, with Editorial Revision (2020).
U. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2017, with Editorial Revision (2020).
V. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).
W. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010, with Errata .
X. NFPA 58 - Liquefied Petroleum Gas Code; 2024, with Amendment.

1.03 SUBMITTALS

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

B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

C. Project Record Documents: Record actual locations of valves.

1.04 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

B. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.06 FIELD CONDITIONS

A. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.01 PROPANE GAS PIPING, BURIED BEYOND 5 FEET OF BUILDING

A. Copper Tube: ASTM B88 (ASTM B88M), Type K (A) annealed.
   1. Fittings: ASME B16.26, cast bronze.
   2. Joints: Flared.

B. Polyethylene Pipe: ASTM D2513, SDR 11.
   1. Fittings: ASTM D2683 or ASTM D2513 socket type.
   2. Joints: Fusion welded.

2.02 PROPANE GAS PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Copper Tube: ASTM B88 (ASTM B88M), Type K (A) annealed.
   1. Fittings: ASME B16.26, cast bronze.
   2. Joints: Flared.

2.03 PROPANE 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: NFPA 58, threaded or welded to ASME B31.1.

B. Copper Tube: ASTM B88 (ASTM B88M), Type K (A) annealed.
   1. Fittings: ASME B16.26, cast bronze.
   2. Joints: Flared.

C. Copper Tube: Listed, ASTM B88 (ASTM B88M), Type K (A), annealed.
   1. Fittings: ASME B16.18 cast copper or ASME B16.22 wrought copper.
   2. Joints: Compression connection or AWS A5.8M/A5.8, BCuP silver braze.
   3. Mechanical Press Sealed Fittings: Double-pressed type and approved or certified, utilizing EPDM, nontoxic, synthetic rubber sealing elements.

D. Flexible Gas Piping:
   1. Corrugated Stainless Steel Tubing: Comply with ANSI LC 1/CSA 6.26.
   2. Comply with ASTM E84.

3. Fittings: Provided by piping system manufacturer.
4. Provide piping with integral lightning protection.
5. Manufacturers:
    a. Omega Flex, Inc; TracPipe CounterStrike: www.omegaflex.com/#sle.
    b. Parker Hannifin Corporation; Parflex Division.
    c. Titeflex.
    d. Tru-Flex Metal Hose Corp.
    e. Substitutions: See Section 23 0500 - HVAC General Provisions.

2.04 FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 2 Inches and Under:
    1. Ferrous Pipe: Class 150 malleable iron threaded unions.
    2. Copper Tube and Pipe: Class 150 bronze unions with soldered joints.
B. Flanges for Pipe Size Over 2 Inch:
    1. Ferrous Pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
    2. Copper Tube and Pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.
C. Welded Fittings:
    1. Systems with gas pressure 2 psi and higher.
    2. Ferrous piping larger than 2".
    3. Ferrous piping in inaccessible areas.
D. Cold Press Mechanical Joint Fittings:
    1. Manufacturer: Viega.
    2. Conform to requirements of ASTM A420 or ASME B16.3 and performance criteria ANSI LC-4/CSA 6.32.
    3. Piping: Schedule 10 to 40 carbon steel pipe, conforming to ASTM A53 and A106.
    4. Pipe Sizes: ½" to 4".
    5. Systems: Gas pressure 5 psi and lower.
    6. Sealing Elements: HNBR, factory installed or an alternative supplied by fitting manufacturer.
    7. Leakage Path: Press ends shall assure leakage of fluids from inside the system past the sealing element of unpressed connections to alert installer of unpressed connections.

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. 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.
    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 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 under pipe to top of roofing.
f. Manufacturers:
1) Cooper B-Line.
2) C-Port; Clearline Technologies.
3) C-Port; MIFAB.
4) Erico.
5) Substitutions: See Section 23 0500 - HVAC General Provisions.

B. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:
1. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.
2. Masonry Wedge Expansion Anchors: Complying with ICC-ES AC01.
3. Concrete Screw Type Anchors: Complying with ICC-ES AC193.
4. Masonry Screw Type Anchors: Complying with ICC-ES AC106.
5. Other Types: As required.

2.06 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. Anvil International: www.anvilintl.com/#sle.
6. Nexus Valve.
7. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
8. Viega, LLC.
9. Substitutions: See Section 23 0500 - HVAC General Provisions.

B. Construction, 4 Inches and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze or ductile iron body, 304 stainless steel or chrome plated brass ball, regular port, Teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, solder or threaded ends with union.

2.07 STRAINERS

A. Manufacturers:
1. Armstrong International, Inc; _____: www.armstronginternational.com/#sle.
2. Maxitrol.
3. Substitutions: See Section 23 0500 - HVAC General Provisions.

B. Size 2 inch 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.

C. Size 1-1/2 inch to 4 inch:
1. Class 125, flanged iron body, Y pattern with 1/16 inch stainless steel perforated screen.

2.08 LINE PRESSURE REGULATORS AND APPLIANCE REGULATORS INDICATORS

A. Manufacturers:

1. Maxitrol Company: www.maxitrol.com/#sle.
2. RegO Products.
3. Fisher; Emerson Electric Company.
4. Marshall Excelsior Company.
5. Substitutions: See Section 23 0500 - HVAC General Provisions.

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.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Entire installation shall comply with NFPA pamphlet No. 54 entitled “Gas Appliance and Gas Piping” and NFPA 58 Liquefied Petroleum Gas Code.
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 clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
G. Provide access where valves and fittings are not exposed.
H. Install valves with stems upright or horizontal, not inverted.
I. Connect branch piping from top or side of horizontal piping.
J. Pipe vents from gas pressure reducing valves to outdoors and terminate in weather proof hood.
K. Do not use propane piping as grounding electrode.
L. Install strainer on inlet of each electrically operated valve.
M. Sleeve pipes passing through partitions, walls and floors.
N. Pipe Hangers and Supports:
1. Install in accordance with ASME B31.9.
2. Support horizontal piping as indicated.
3. Place hangers within 12 inches of each horizontal elbow.
4. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
6. Provide copper plated hangers and supports for copper piping.

O. Install propane piping electrically continuous and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.

1. Corrugated stainless steel tubing (CSST) shall be bonded to the electrical service grounding electrode system. The bonding jumper shall connect to a metallic pipe or fitting between the point of delivery and the first downstream CSST fitting. The bonding jumper shall not be smaller than 6 AWG copper wire or equivalent.

P. Prime and paint all exterior ferrous metal piping to protect from corrosion.

3.03 PRESSURE REGULATORS

A. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.

B. Provide regulators at appliances as required.

C. Install strainer on inlet of each line-pressure regulator.

3.04 APPLICATION

A. Install unions downstream of valves and at equipment or apparatus connections.

B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

C. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

D. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

1. Construct sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 6 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

E. Provide strainer of size equivalent to pipe shown on the drawings. Locate the filter after sediment trap and before the regulator. Install per the manufacturer instructions and per NFPA 85 and NFPA 86 requirements.

3.05 SERVICE CONNECTIONS

A. Piping Between Tanks and Secondary Regulator:

1. Installed by LP provider as a subcontractor to the Mechanical Contractor.
2. Tubing shall be installed in a 6” bed of sand a minimum of 18” below grade and a #14 THHN locating wire shall be buried with the pipe.
3. Provide marker tape labeled “GAS” and bury above the propane piping 12” below grade.

B. Prime and paint all exterior steel piping to protect from corrosion.

1. Clean piping to remove loose dirt and debris prior to applying primer. Sand any rust spots with 220-grit sandpaper; rinse pipe with water and allow to dry.
2. Apply metal primer paint to clean exterior piping.
3. Apply two coats of enamel-based metal topcoat paint. Allow the first coat to thoroughly dry before applying second coat.

C. Underground copper tubing shall extend 12” above ground on all risers.

3.06 SCHEDULES

A. Pipe Hanger Spacing:

1. Metal Piping:
   a. Pipe Size: 1/2 inches to 1-1/4 inches:
      1) Maximum Hanger Spacing: 6.5 ft.
      2) Hanger Rod Diameter: 3/8 inches.
   b. Pipe size: 1-1/2 inches to 2 inches:
      1) Maximum Hanger Spacing: 10 ft.

2) Hanger Rod Diameter: 3/8 inch.

c. Pipe size: 2-1/2 inches to 3 inches:
   1) Maximum Hanger Spacing: 10 ft.
   2) Hanger Rod Diameter: 1/2 inch.

d. Pipe size: 4 inches to 6 inches:
   1) Maximum Hanger Spacing: 10 ft.
   2) Hanger Rod Diameter: 5/8 inch.

END OF SECTION

SECTION 23 2113 - HYDRONIC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hydronic system requirements.
B. Heating water and glycol piping, above grade.
C. Radiant heating piping system.
D. Equipment drains and overflows.
E. Pipe hangers and supports.
F. Unions, flanges, mechanical couplings, and dielectric connections.
G. Valves:
    1. Ball valves.
    2. Butterfly valves.
    3. Check valves.

1.02 RELATED REQUIREMENTS

A. Section 23 0516 - Expansion Fittings and Loops for HVAC Piping.
B. Section 23 0719 - HVAC Piping Insulation.
C. Section 23 2500 - HVAC Water Treatment: Pipe cleaning.

1.03 REFERENCE STANDARDS

A. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2021.
B. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard; 2020.
C. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.
D. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.
E. ASME B31.9 - Building Services Piping; 2020.
F. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2024.
G. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2024.
H. ASTM A536 - Standard Specification for Ductile Iron Castings; 2024.
I. ASTM B32 - Standard Specification for Solder Metal; 2020.
J. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.
K. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2020.
L. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2021a.
M. ASTM D2241 - Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series); 2025.
N. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40; 2024.
O. ASTM D2467 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80; 2020.
P. ASTM D2774 - Standard Practice for Underground Installation of Thermoplastic Pressure Piping; 2021a.

Q. 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).

R. ASTM F1960 - Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-Linked Polyethylene (PEX) and Polyethylene of Raised Temperature (PE-RT) Tubing; 2024.

S. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers; 2024.

T. ASTM F876 - Standard Specification for Crosslinked Polyethylene (PEX) Tubing; 2024b.

U. ASTM F877 - Standard Specification for Crosslinked Polyethylene (PEX) Hot- and Cold-Water Distribution Systems; 2024.

V. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications; 2007 (Reapproved 2024).

W. ASTM F2389 - Standard Specification for Pressure-Rated Polypropylene (PP) Piping Systems; 2023.

X. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2019.

Y. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).

Z. AWWA C606 - Grooved and Shouldered Joints; 2022.

AA. DIN 4726 - Warm Water Surface Heating Systems and Radiator Connecting Systems - Plastics Piping Systems and Multilayer Piping Systems; 2017.

BB. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).

1.04 SUBMITTALS

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

B. Product Data:
   1. Include data on pipe materials, pipe fittings, valves, and accessories.
   2. Show grooved joint couplings, fittings, valves, and specialties on drawings and product submittals, specifically identified with the manufacturer's style or series designation.

C. Project Record Documents: Record actual locations of valves.

D. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.05 QUALITY ASSURANCE

A. Provide all grooved joint couplings, fittings, valves, specialties, and grooving tools from a single manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

B. 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 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 Engineer.
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 gate valves with cap; pipe to nearest floor drain.
2. Isolate equipment using butterfly valves with lug end flanges or grooved mechanical couplings.
3. For throttling, bypass, or manual flow control services, use ball or butterfly valves.
4. For shut-off and to isolate parts of systems or vertical risers, use ball or butterfly valves.

2.02 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: Sizes 2-1/2 inches and larger; ASTM A234/A234M, wrought steel welding type fittings; AWS D1.1/D1.1M welded.
2. Threaded Joints: Sizes 2 inches and smaller; ASME B16.3, malleable iron fittings.
3. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings.

B. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), drawn, 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. Grooved Joints: AWWA C606 grooved tube, fittings of same material, and copper-tube-dimension mechanical couplings.
3. Tee Connections: Mechanically extracted collars with notched and dimpled branch tube.
4. Mechanical Press Sealed Fittings: Double pressed type complying with ASME B16.22, utilizing EPDM, nontoxic synthetic rubber sealing elements.

C. Pressure-Rated Polypropylene Pipe: ASTM D2774 or ASTM F2389, PP-RCT resin pipe with fiber layer, SDR 11 or SDR 9.

1. Fittings: ASTM F2389, butt, socket, or saddle-weld heat fusion. Transitions to comply with ASTM F1960 or ASME B16.5.
2. Manufacturers:
a. Uponor, Inc; _____: www.uponorpro.com/#sle.
b. Aquatherm.
c. Substitutions: See Section 23 0500 - HVAC General Provisions.

2.03 RADIANT HEATING PIPING

A. Cross-Linked Polyethylene (PEX) Pipe: ASTM F876 or ASTM F877.

1. Manufacturers:
a. Uponor, Inc: www.uponorpro.com/#sle.
b. HeatLink Group Inc.
c. Infloor Radiant Heating Inc.

d. MrPEX Systems, Inc.
e. REHAU.
f. Stadler-Viega.
g. Watts Radiant, Inc.; a division of Watts Water Technologies, Inc.
h. Zurn Plumbing Products Group.
i. Substitutions: See Section 23 0500 - HVAC General Provisions.

2. Fittings: Brass and copper.
3. Joints: Mechanical compression fittings.
   a. No joints allowed underground.
4. Oxygen Barrier: Limit oxygen diffusion through the tube to maximum 0.000044 grains per cu ft/day at 104 degrees F in accordance with DIN 4726.

2.04 EQUIPMENT DRAINS AND OVERFLOWS

A. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), drawn; using one of the following joint types:
   1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings; ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.

B. PVC Pipe: ASTM D1785, Schedule 40, or ASTM D2241, SDR 21 or 26.
   1. Fittings: ASTM D2466 or D2467, PVC.
   2. Joints: Solvent welded in accordance with ASTM D2855.

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: Malleable iron, adjustable swivel, split ring.
   3. Hangers for Cold Pipe Sizes 2 Inches and Greater: Carbon steel, adjustable, clevis.
   4. Hangers for Hot Pipe Sizes 2 to 4 Inches: Carbon steel, adjustable, clevis.
   5. Hangers for Hot Pipe Sizes 6 Inches and Greater: Adjustable steel yoke, cast iron roll, double hanger.
   6. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
   7. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 Inches and Greater: Steel channels with welded spacers and hanger rods, cast iron roll.
   8. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
   9. Wall Support for Pipe Sizes 4 Inches and Greater: Welded steel bracket and wrought steel clamp.
   10. Wall Support for Hot Pipe Sizes 6 Inches and Greater: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.
   11. Vertical Support: Steel riser clamp.
   12. Floor Support for Hot Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
   13. Floor Support for Hot Pipe Sizes 6 Inches and Greater: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
   14. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
   15. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
   16. 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.

B. In grooved installations, use rigid couplings with offsetting angle-pattern bolt pads or with wedge-shaped grooves in header piping to permit support and hanging in accordance with ASME B31.9.

2.06 UNIONS, FLANGES, MECHANICAL COUPLINGS, AND DIELECTRIC CONNECTIONS

A. Unions for Pipe of 2 Inches and Less:
   1. Ferrous Piping: 150 psi brass or malleable iron, threaded.
   2. Copper Pipe: Bronze, soldered joints.

B. Flanges for Pipe 2 Inches and Greater:
   1. Ferrous Piping: 150 psig forged steel, slip-on.
   2. Copper Piping: Bronze.
   3. Gaskets: 1/16 inch thick, preformed neoprene.

C. Mechanical Couplings for Grooved and Shouldered Joints: Two or more curved housing segments with continuous key to engage pipe groove, circular C-profile gasket, and bolts to secure and compress gasket.
   1. Dimensions and Testing: In accordance with AWWA C606.
   2. Mechanical Couplings: Comply with ASTM F1476.
   3. Housing Material: Ductile iron, galvanized complying with ASTM A536.
   4. Gasket Material: EPDM suitable for operating temperature range from minus 30 degrees F to 230 degrees F.
   5. Bolts and Nuts: Hot dipped galvanized or zinc-electroplated steel.
   6. When pipe is field grooved, provide coupling manufacturer's grooving tools.
   7. Manufacturers:
      a. Anvil International; _____: www.anvilintl.com/#sle.
      b. Apollo Valves; _____: www.apollovalves.com/#sle.
      c. Grinnell Products; _____: www.grinnell.com/#sle.
      d. Victaulic Company; _____: www.victaulic.com/#sle.
      e. Substitutions: See Section 23 0500 - HVAC General Provisions.

D. Dielectric Connections:
   1. Waterways:
      a. Water impervious insulation barrier capable of limiting galvanic current to 1 percent of short circuit current in a corresponding bimetallic joint.
      b. Dry insulation barrier able to withstand 600-volt breakdown test.
      c. Construct of galvanized steel with threaded end connections to match connecting piping.
      d. Suitable for the required operating pressures and temperatures.
   2. Flanges:
      a. Dielectric flanges with same pressure ratings as standard flanges.
      b. Water impervious insulation barrier capable of limiting galvanic current to 1 percent of short circuit current in a corresponding bimetallic joint.
      c. Dry insulation barrier able to withstand 600-volt breakdown test.
      d. Construct of galvanized steel with threaded end connections to match connecting piping.
      e. Suitable for the required operating pressures and temperatures.
   3. Unions:
      a. 1/2 to 1 Inches: Brass solder to galvanized FPT.
      b. 1/2 to 2 Inches: Brass solder to galvanized FPT.
      c. 1/2 to 1 Inches: Brass to galvanized FPT or FIP (Female Iron Pipe).
      d. 3/4 to 1/2 Inch Reducer: Brass solder to galvanized FPT.

e. Service: 250 psi, minus 20 to 180 deg F.

2.07 BALL VALVES

A. Manufacturers:
1. Anvil International: www.anvilintl.com/#sle.
2. Apollo Valves: www.apollovalves.com/#sle.
3. Grinnell Products: www.grinnell.com/#sle.
4. Victaulic Company: www.victaulic.com/#sle.
5. Milwaukee Valve Company.
6. Nexus Valve.
7. NIBCO INC.
8. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
9. Viega, LLC.
10. Substitutions: See Section 23 0500 - HVAC General Provisions.

B. Up To and Including 2 Inches:
1. Bronze one piece body, chrome plated brass ball, teflon seats and stuffing box ring, lever handle with balancing stops, solder ends with union.

2.08 BUTTERFLY VALVES

A. Manufacturers:
1. Anvil International: www.anvilintl.com/#sle.
2. Apollo Valves: www.apollovalves.com/#sle.
3. Grinnell Products: www.grinnell.com/#sle.
4. Victaulic Company: www.victaulic.com/#sle.
5. Milwaukee Valve Company.
6. Nexus Valve.
7. NIBCO INC.
8. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
9. Viega, LLC.
10. Substitutions: See Section 23 0500 - HVAC General Provisions.

B. Body: Cast or ductile iron with resilient replaceable EPDM seat, wafer, lug, or grooved ends, extended neck.

C. Disc: Construct of aluminum bronze, chrome plated ductile iron, stainless steel, ductile iron with EPDM encapsulation, or Buna-N encapsulation.

D. Operator: 10 position lever handle.

2.09 SWING CHECK VALVES

A. Manufacturers:
1. Anvil International: www.anvilintl.com/#sle.
2. Apollo Valves: www.apollovalves.com/#sle.
3. Grinnell Products: www.grinnell.com/#sle.
4. Victaulic Company: www.victaulic.com/#sle.
5. Milwaukee Valve Company.
6. Nexus Valve.
7. NIBCO INC.
8. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
9. Viega, LLC.

10. Substitutions: See Section 23 0500 - HVAC General Provisions.

B. Up To and Including 2 Inches:
   1. Bronze body, bronze trim, bronze rotating swing disc, with composition disc, solder ends.

C. Over 2 Inches:
   1. Iron body, bronze trim, stainless steel, bronze, or bronze faced rotating swing disc, renewable disc and seat, flanged or grooved ends.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Prepare pipe for grooved mechanical joints as required by coupling manufacturer.

C. Remove scale and dirt on inside and outside before assembly.

D. Prepare piping connections to equipment using jointing system specified.

E. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

F. After completion, fill, clean, and treat systems. See Section 23 2500 for additional requirements.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.

C. Route piping in orderly manner, parallel to building structure, and maintain gradient.

D. Install piping to conserve building space and to avoid interference with use of space.

E. Group piping whenever practical at common elevations.

F. Sleeve pipe passing through partitions, walls, and floors.

G. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified.

H. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. See Section 23 0516.
   1. Flexible couplings may be used in header piping to accommodate thermal growth, thermal contraction in lieu of expansion loops.
   2. Use flexible couplings in expansion loops.

I. Grooved Joints:
   1. Install in accordance with the manufacturer's latest published installation instructions.
   2. Gaskets to be suitable for the intended service, molded, and produced by the coupling manufacturer.

J. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.9, ASTM F708, or MSS SP-58.
   2. Place hangers within 12 inches of each horizontal elbow.
   3. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
   4. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
   5. Provide copper plated hangers and supports for copper piping.

K. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. See Section 23 0719.

3.03 SCHEDULES

A. Hanger Spacing for Copper Tubing.
   1. 1 Inch: Maximum span, 6 feet; minimum rod size, 1/4 inch.
   2. 1-1/2 Inches and 2 Inches: Maximum span, 8 feet; minimum rod size, 3/8 inch.
   3. 2-1/2 Inches: Maximum span, 9 feet; minimum rod size, 3/8 inch.
   4. 3 Inches: Maximum span, 10 feet; minimum rod size, 3/8 inch.
   5. 4 Inches: Maximum span, 12 feet; minimum rod size, 1/2 inch.

B. Hanger Spacing for Steel Piping.
   1. 1/2 Inch, 3/4 Inch, and 1 Inch: Maximum span, 7 feet; minimum rod size, 1/4 inch.
   2. 1-1/4 Inches: Maximum span, 8 feet; minimum rod size, 3/8 inch.
   3. 1-1/2 Inches: Maximum span, 9 feet; minimum rod size, 3/8 inch.
   4. 2 Inches: Maximum span, 10 feet; minimum rod size, 3/8 inch.
   5. 2-1/2 Inches: Maximum span, 11 feet; minimum rod size, 3/8 inch.
   6. 3 Inches: Maximum span, 12 feet; minimum rod size, 3/8 inch.
   7. 4 Inches: Maximum span, 14 feet; minimum rod size, 1/2 inch.
   8. 6 Inches: Maximum span, 17 feet; minimum rod size, 1/2 inch.
   9. 8 Inches: Maximum span, 19 feet; minimum rod size, 5/8 inch.

C. Hanger Spacing for Plastic Piping.
   1. 1/2 Inch: Maximum span, 42 inches; minimum rod size, 1/4 inch.
   2. 3/4 Inch: Maximum span, 45 inches; minimum rod size, 1/4 inch.
   3. 1 Inch: Maximum span, 51 inches; minimum rod size, 1/4 inch.
   4. 1-1/4 Inches: Maximum span, 57 inches; minimum rod size, 3/8 inch.
   5. 1-1/2 Inches: Maximum span, 63 inches; minimum rod size, 3/8 inch.
   6. 2 Inches: Maximum span, 69 inches; minimum rod size, 3/8 inch.
   7. 3 Inches: Maximum span, 7 feet; minimum rod size, 3/8 inch.
   8. 4 Inches: Maximum span, 8 feet; minimum rod size, 1/2 inch.
   9. 6 Inches: Maximum span, 10 feet; minimum rod size, 1/2 inch.

END OF SECTION

SECTION 23 2114 - HYDRONIC SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Expansion tanks.
B. Air vents.
C. Air separators.
D. Strainers.
E. Pressure-temperature test plugs.
F. Balancing valves.
G. Automatic flow control valves.
H. Relief valves.
I. Glycol system.

1.02 RELATED REQUIREMENTS

A. Section 23 2500 - HVAC Water Treatment: Pipe cleaning.

1.03 REFERENCE STANDARDS

A. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels; 2023.

1.04 SUBMITTALS

A. 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.
B. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.
C. Project Record Documents: Record actual locations of flow controls.
D. 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. American Wheatley, a company of Global Flow Products, LLC: www.wheatleyhvac.com/#sle.
   2. Amtrol Inc: www.amtrol.com/#sle.
   3. Bell & Gossett, a brand of Xylem, Inc: www.bellgossett.com/#sle.
   4. Taco, Inc: www.taco-hvac.com/#sle.
   5. Armstrong Pumps, Inc.
   6. Niles Steel Tank.

7. Wessels Company.
8. Substitutions: See Section 23 0500 - HVAC General Provisions.

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, and steel support stand.

C. Automatic Cold Water Fill Assembly: Pressure reducing valve, reduced pressure double check backflow preventer, test cocks, strainer, vacuum breaker, and valved by-pass. Provide where shown.

2.02 AIR VENTS

A. Manufacturers:
1. Armstrong International, Inc: www.armstronginternational.com/#sle.
2. Bell & Gossett, a brand of Xylem, Inc: www.bellgossett.com/#sle.
3. Nexus Valve, Inc: www.nexusvalve.com/#sle.
4. Taco, Inc: www.taco-hvac.com/#sle.
5. Armstrong Pumps, Inc.
6. Wessels Company.
7. Substitutions: See Section 23 0500 - HVAC General Provisions.

B. Manual Air Vent: Short vertical sections of 2-inch diameter pipe to form air chamber, with 1/8 inch 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.

D. Maximum Fluid Pressure: 150 psi.

E. Maximum Fluid Temperature: 250 degrees F.

2.03 AIR SEPARATORS

A. In-line Air Separators:
1. Manufacturers:
a. American Wheatley, a company of Global Flow Products, LLC: www.wheatleyhvac.com/#sle.
b. Armstrong International, Inc: www.armstronginternational.com/#sle.
c. Bell & Gossett, a brand of Xylem, Inc: www.bellgossett.com/#sle.
d. Taco, Inc: www.taco-hvac.com/#sle.
e. Wessels Company.
f. Substitutions: See Section 23 0500 - HVAC General Provisions.
2. Cast iron for sizes 1-1/2 inch and smaller, or steel for sizes 2 inch and larger; tested and stamped in accordance with ASME BPVC-VIII-1; for 125 psi operating pressure.
3. Maximum Allowable Service Temperature: 450 degrees F.
4. Accessories: Provide drain ball valve.

2.04 STRAINERS

A. Manufacturers:
1. American Wheatley, a company of Global Flow Products, LLC: www.wheatleyhvac.com/#sle.
2. Armstrong International, Inc: www.armstronginternational.com/#sle.
3. Grinnell Products: www.grinnell.com/#sle.
4. Nexus Valve, Inc: www.nexusvalve.com/#sle.
5. The Metraflex Company: www.metraflex.com/#sle.

6. Bell & Gossett, a brand of Xylem, Inc: www.bellgossett.com/#sle.
7. Substitutions: See Section 23 0500 - HVAC General Provisions.

B. Size 2 inch and Under:
1. Provide threaded, grooved, or sweat brass or iron body for up to 175 psi working pressure, Y-pattern strainer with 1/32 inch stainless steel perforated screen.
2. Body Material by Fluid Service:
a. Cast Iron or Brass:
1) Steam: Up to 250 psi at 450 degrees F.
2) Liquids: Up to 400 psi at 150 degrees F.

C. Size 2-1/2 inch to 4 inch:
1. Provide flanged or grooved iron body for up to 175 psi working pressure, up to 250 degrees F working temperature, Y-pattern strainer with 1/16 inch or 3/64 inch stainless steel perforated screen.
2. Body Material by Fluid Service:
a. Cast Iron:
1) Steam: Up to 125 psi at 350 degrees F.
2) Liquids: Up to 200 psi at 150 degrees F.

D. Basket-Type, Size 1 to 30 inch for Liquid Service:
1. Flanged carbon steel body with 1/8 inch stainless steel perforated basket screen, bottom drain and capped air vent.
2. Fluid Service: Up to 285 psi at 100 degrees F.

E. Accessories: Provide air vent, blowdown vent/drain, hanging tag, outlet ball valve, and PT test plug extension when installed on a coil.

2.05 PUMP CONNECTORS

A. Manufacturers:
1. The Metraflex Company: www.metraflex.com/#sle.
2. Flexicraft Industries.
3. Mason-Mercer.
4. Minnesota Flexible Corp.
5. Twin City Hose.
6. Substitutions: See Section 23 0500 - HVAC General Provisions.

B. Flexible Connectors: Flanged, braided type with wetted components of stainless steel, sized to match piping.
1. Maximum Operating Service: 150 psi at 120 degrees F.
2. Accommodate the Following:
a. Lateral Movement: 3/4 inch.
b. Angular Rotation: 15 degrees.
c. Force developed by 1.5 times specified maximum allowable operating pressure.
3. End Connections: Same as specified for pipe jointing.
4. 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.

B. Application: Use extended length plugs to clear insulated piping.

2.07 BALANCING VALVES

A. Manufacturers:
   1. Bell & Gossett, a brand of Xylem, Inc: www.bellgossett.com/#sle.
   2. Hays Fluid Controls: www.haysfluidcontrols.com/#sle.
   3. Nexus Valve, Inc: www.nexusvalve.com/#sle.
   4. Gerand Engineering Co.
   5. Tour & Andersson.
   6. Viega, LLC.
   7. Substitutions: See Section 23 0500 - HVAC General Provisions.

B. Size 2 inch and Smaller:
   1. Provide ball or globe style with flow balancing, shut-off capabilities, memory stops, and minimum of two metering ports and female sweat, NPT threaded, press, or soldered connections.
   2. Metal construction materials consist of bronze or brass.
   3. Non-metal construction materials consist of Teflon, EPDM, or engineered resin.

C. Size 2-1/2 inch and Larger:
   1. Provide ball, globe, or butterfly style with flow balancing, shut-off capabilities, memory stops, and minimum of two metering ports and flanged, grooved, or weld-end connections.
   2. Valve body construction materials consist of cast iron, carbon steel, or ductile iron.
   3. Internal components construction materials consist of brass, aluminum bronze, bronze, Teflon, EPDM, NORYL, or engineered resin.

D. Accessories: Provide hanging tag.

2.08 AUTOMATIC FLOW CONTROL VALVES

A. Manufacturers:
   1. Bell & Gossett, a brand of Xylem, Inc: www.bellgossett.com/#sle.
   2. Hays Fluid Controls: www.haysfluidcontrols.com/#sle.
   3. Nexus Valve, Inc: www.nexusvalve.com/#sle.
   4. Gerand Engineering Co.
   5. Tour & Andersson.
   6. Viega, LLC.
   7. Substitutions: See Section 23 0500 - HVAC General Provisions.

B. 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.

C. 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.

D. 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.

E. Size: Match system flow capacity.

F. Accessories: Provide hanging tag, inlet in-line strainer, outlet ball valve, and PT test plug extension.

2.09 RELIEF VALVES

A. Bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labelled.

B. Steam Relief at Maximum Vessel Pressure: 50 psi.

2.10 GLYCOL SYSTEM

A. Manufacturers:
   1. Axiom Industries, LTD.
   2. ITT Bell & Gossett.
   3. J.L. Wingert Company.
   4. Neptune Chemical Pump Company.
   5. Substitutions: See Section 23 0500 - HVAC General Provisions.

B. Pump System:
   1. Storage: 15 gal polypropylene tank with bolt-removable hinged solid cover and enamel coated carbon steel tank-stand.
   2. Pump:
      a. Thermally protected 1/4 hp motor at 115 to 120 VAC, single phase rated for indoor service.
      b. Maximum Service Operation: 100 psi at 85 degrees F.
   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 cut-in and 40 psi cut-out, adjustable.
      d. Low Level Cut-Off Switch: Prewired to shut-down unit upon activation. Tank-side mounted.
      e. Auxiliary Dry Contacts: Low level, high level, and fault/alarm for remote monitoring.
   5. Pressure Relief Valve: System-mounted brass valve tubed from pump discharge side into tank with adjustable setpoint between 20 psi and 150 psi.

C. Glycol Solution:
   1. Manufacturers:
      a. Dow Chemical.
      b. Houghton Chemical Corporation.
      c. JeffCool Products.
      d. Rhomar Water Products.
   2. Water-based solution mix containing 30% ethylene glycol.
      a. Glycol: Industrial grade with corrosion inhibitors and environmental-stabilizer additives.
   3. Water quality requirements:
      a. Maximum Concentrations: Chlorides, 25 ppm; Sulfates, 25 ppm; Calcium, 50 ppm; Magnesium, 50 ppm.
      b. Total Hardness: Less than 100 ppm.
      c. Provide water test results to engineer prior to filling system.
      d. If any of the above categories are exceeded, the Contractor shall use a factory premixed water/glycol solution or obtain distilled or deionized water to dilute the glycol to the strength specified.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install specialties in accordance with manufacturer's instructions.
B. Provide manual air vents at system high points and as indicated.
C. Provide air separator on suction side of system circulation pump and connect to expansion tank.
D. Provide valved drain and hose connection on strainer blowdown connection.
E. Support pump fittings with floor-mounted pipe and flange supports.
F. Provide relief valves on pressure tanks, low-pressure side of reducing valves, heat exchangers, and expansion tanks.
G. Pipe relief valve outlet to nearest floor drain.
H. Where one line vents several relief valves, make cross-sectional area equal to sum of individual vent areas.

3.02 WATER FLOW CONTROL DEVICES

A. Provide on return connection for all hydronic heat transfer devices with scheduled flows.
B. Furnish with chained metal tag showing location, size, GPM, and meter reading.

3.03 GLYCOL SYSTEM

A. Clean and flush glycol system before adding glycol solution, see Section 23 2500.
B. Feed glycol solution to system through make-up line with pressure regulator, venting system high points.
C. After glycol solution is circulated for a minumum of 10 hours, perform tests determining strength of glycol and water solution and submit written test results.
D. Install glycol make-up unit as shown on Drawings, located next to main system expansion tank. Connect into piping to expansion tank. Provide application specific pressure reducing valve between GMU and connection to the system piping. Pipe according to manufacturer recommendation.
E. Attach tag near the system fill connection indicating manufacturer name, brand name/number and protection level (ºF) of the Glycol water solution.

3.04 MAINTENANCE

A. Provide service and maintenance of glycol system for one year from date of Substantial Completion at no extra charge to Owner.
B. Perform monthly visit to make glycol fluid concentration analysis on site with refractive index measurement instrument. Report findings in detail in writing, including analysis and amounts of glycol or water added.
C. Explain corrective actions to Owner's maintenance personnel in person.

END OF SECTION

SECTION 23 2123 - HYDRONIC PUMPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wet rotor circulators.

B. Circulators.

C. In-line pumps.

1.02 RELATED REQUIREMENTS

A. Section 23 0513 - Common Motor Requirements for HVAC Equipment.

B. Section 23 0934 - Variable-Frequency Motor Controllers 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. 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.

B. Operation and Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. Extra Pump Seals: One set for each type and size of primary pump scheduled.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Armstrong Fluid Technology, Inc: www.armstrongfluidtechnology.com/#sle.

B. Bell & Gossett, a Xylem Inc. brand: www.bellgossett.com/#sle.

C. Grundfos Pumps Corporation: www.grundfos.com/#sle.

D. Taco, Inc.

E. Thrush Company, Inc.

F. Wilo USA, LLC.

G. Substitutions: See Section 23 0500 - HVAC General Provisions.

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 23 0934, except for integral-VFDs.

2.03 WET ROTOR CIRCULATORS

A. Horizontal shaft, single stage, direct connected with multiple speed wet rotor motor for in-line mounting, for 140 psi maximum working pressure, 230 degrees F maximum water temperature.
B. Casing: Cast iron with flanged pump connections.
C. Impeller, Shaft, Rotor: Stainless Steel.
D. Bearings: Metal Impregnated carbon (graphite) and ceramic.
E. Motor: Impedance protected, multiple speed, with external speed selector.

2.04 CIRCULATORS

A. Horizontal shaft, single-stage pump with direct connected, resilient-mount, oil lubricated motor for discharge pressures of up to 125 psi.
B. Casing: Cast iron, with flanged pump connections.
C. Impeller: Non-ferrous keyed to shaft.
D. Bearings: Oil-lubricated bronze sleeve.
E. Shaft: Alloy steel with bronze sleeve, integral thrust collar.
F. Seal: Mechanical seal, 225 degrees F maximum continuous duty temperature.
G. Drive: Flexible coupling.
H. Electrical:
    1. Motor: 1,750 rpm unless indicated otherwise; see Section 23 0513.
    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.

2.05 IN-LINE PUMPS

A. Closed-Coupled, Single-Stage Pump: Vertical pump with radially- or horizontally-split casing; rated for discharge pressures up to 175 psi.
B. Casing: Cast iron with seal flush connection, threaded suction, and discharge ports with gauge port and drain plug.
C. Impeller: Bronze, fully enclosed, keyed directly to motor shaft or extension.
D. Shaft: Carbon steel with stainless steel impeller cap screw or nut and bronze sleeve.
E. Seal: Mechanical seal, 225 degrees F maximum continuous duty temperature.
F. Electrical:
    1. Motor: 1,750 rpm unless specified otherwise; see Section 23 0513.
    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 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. Install pressure gages on pump suction and discharge or at integral pressure-gage tapping, or install single gage with multiple-input selector valve.

D. Support piping adjacent to pump such that no weight is carried on pump casings. For close-coupled or base-mounted pumps, provide supports under elbows on pump suction and discharge line sizes 4 inches and over.

E. Lubricate pumps before start-up.

END OF SECTION

SECTION 23 3100 - HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal ducts.

B. Flexible ducts.

C. Air plenums and casings.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 23 0130.51 - HVAC Air-Distribution System Cleaning: Post install duct cleaning.

C. Section 23 0713 - Duct Insulation: External insulation and duct liner.

D. Section 23 3319 - Duct Silencers.

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; 2023.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.

D. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements; 2018, with Editorial Revision (2020).

E. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry; 2018, with Editorial Revision (2020).

F. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2017, with Editorial Revision (2020).

G. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements; 2023.

H. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

I. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

J. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. Product Data: Provide data for duct materials.

B. Shop Drawings: Indicate duct fitting types, gauges, sizes, welds, and configuration.

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.

C. Acoustical Treatment: Provide sound-absorbing liners and sectional silencers for metal-based ducts in compliance with Section 23 3319.

D. Duct Shape and Material in accordance with Allowed Static Pressure Range:

1. Round: Plus or minus 2 in-wc of galvanized steel.

2. Rectangular: Plus or minus 1/2 in-wc of galvanized steel.

E. Duct Sealing and Leakage in accordance with Static Pressure Class:
   1. Duct Pressure Class and Material for Common Mechanical Ventilation Applications:
      a. Supply Air: 1/2 in-wc pressure class, galvanized steel.
      b. Return and Relief Air: 1/2 in-wc pressure class, galvanized steel.
      c. General Exhaust Air: pressure class, galvanized steel.

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.

2.02 METAL DUCTS

A. Material Requirements:
   1. Galvanized Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.

B. Round Spiral Duct:
   1. Round spiral lock seam duct with galvanized steel outer wall.

C. Connectors, Fittings, Sealants, and Miscellaneous:
   1. Fittings: Manufacture with solid inner wall of perforated galvanized steel.
   2. Transverse Duct Connection System: SMACNA "E" rated rigid class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips in accordance with SMACNA (DCS).
   3. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
      a. 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.
      b. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with ASTM E84.
   4. Gasket Tape:
      a. Provide butyl rubber gasket tape for a flexible seal between transfer duct connector (TDC), transverse duct flange (TDF), applied flange connections, and angle ring connections.
   5. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

6. Hanger Fasteners: Attach hangers to structure using appropriate fasteners as follows:
    a. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.
    b. Masonry Wedge Expansion Anchors: Complying with ICC-ES AC01.
    c. Concrete Screw Type Anchors: Complying with ICC-ES AC193.
    d. Masonry Screw Type Anchors: Complying with ICC-ES AC106.
    e. Concrete Adhesive Type Anchors: Complying with ICC-ES AC308.
    f. Other Types: As required.

2.03 FLEXIBLE DUCTS

A. Flexible Ducts: UL 181, Class 1, polyethylene film, mechanically fastened and rolled using galvanized steel to form spiral helix.
    1. Insulation: R6 insulation with aluminized vapor barrier film.
    2. Pressure Rating: 10 in-wc positive and 5 in-wc negative.
    3. Maximum Velocity: 5500 fpm.
    4. Temperature Range: Minus 20 degrees F to 250 degrees F.

2.04 AIR PLENUMS AND CASINGS

A. Fabricate in accordance with SMACNA (DCS) for indicated operating pressures indicated.
B. Minimum Fabrication Requirements:
    1. Fabricate acoustic plenum or casing with reinforcing turned inward.
    2. Provide 16-gauge, 0.059-inch sheet steel back facing and 22-gauge, 0.029-inch perforated sheet steel front facing with 3/32 inch diameter holes on 5/32 inch centers.
    3. Construct panels 3 inches thick, packed with 4.5 pcf minimum glass fiber insulation media, on inverted channel of 16-gauge, 0.059-inch sheet steel.
    4. Mount floor-mounted plenum or casings on 4-inch high concrete curbs. At floor, rivet panels on 8-inch centers to angles. Where floors are acoustically insulated, provide liner of galvanized 18-gauge, 0.052-inch expanded metal mesh supported at 12-inch centers, turned up 12 inches at sides with sheet metal shields.
C. Access Doors:
    1. Install hinged access doors where indicated or required for access to equipment for cleaning and inspection.
    2. Reinforce door frames with steel angles tied to horizontal and vertical plenum supporting angles.
    3. Provide clear wire glass observation ports, minimum 6 by 6 inch size.

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. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
D. Flexible Ducts: Connect to metal ducts with adhesive.
E. Duct sizes indicated are precise inside dimensions. For lined ducts, maintain sizes inside lining.
F. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
G. Connect terminal units to supply ducts directly or with one foot maximum length of flexible duct. Do not use flexible duct to change direction.

H. Fire Partitions: Provide firestopping sealing. See Section 07 8400.

I. Duct Insulation: Provide duct insulation. See Section 23 0713.

J. Ductwork shall be run as high as possible in all rooms to maintain proper headroom. Where two or more ducts cross each other, they must be arranged in such a manner as to maintain the greatest possible clearance underneath.

K. Ductwork shall not cover any electrical outlets or junction boxes. Consult with other trades to avoid interference with piping runs, etc.

L. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

M. Ducts shall conform to dimensions on the Drawings unless location of structural members prohibit. Make minor changes in run of certain ducts without extra cost to the Owner if necessary to avoid unforeseen structural or other interferences.

N. All ducts shall be straight and smooth on the inside with finished joints. No inside standing seams will be permitted in ductwork. No single thickness partitions shall be allowed between ducts. The Engineer reserves the right to order any open seams or joints made tight by caulking or taping. No open joints at corners or elsewhere will be allowed.

O. Where space permits, elbows shall have a centerline radius equal to 1½ times their width. Shorter radius and square throat elbows shall be used where required to fit restricted areas only and where required by the duct connection details on the Drawings. All short radius and square throat elbows shall be provided with turning vanes.

P. Watertight drip pans shall be provided below all power vent, relief vent, gravity vent, fresh air and exhaust openings through roof, either built into the ductwork or, if no duct is installed, independently suspended below opening. All fresh air, exhaust air and relief air louver plenums shall have watertight seams on bottom portion of plenums. All fresh air ductwork and other ductwork, as noted on the Plans, shall be caulked watertight.

3.02 CLEANING

A. Clean thoroughly each duct system. See Section 23 0130.51.

END OF SECTION

SECTION 23 3300 - 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.

1.02 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.

1.03 SUBMITTALS

A. See Section 01 3000 - 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. Project Record Drawings: Record actual locations of access doors and test holes.

1.04 QUALITY ASSURANCE

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 AIR TURNING DEVICES/EXTRACTORS

A. Manufacturers:
   1. Krueger-HVAC, Division of Air System Components: www.krueger-hvac.com/#sle.
   2. Ruskin Company: www.ruskin.com/#sle.
   3. Titus HVAC, a brand of Johnson Controls: www.titus-hvac.com/#sle.
   4. Tuttle & Bailey.
   5. Nailor Industries, Inc: www.nailor.com/#sle.
   6. Substitutions: See Section 23 0500 - HVAC General Provisions.
B. Multi-blade device with radius blades attached to pivoting frame and bracket, steel construction, with push-pull operator strap.

2.02 MANUAL VOLUME DAMPERS

A. Manufacturers:
   1. Louvers & Dampers, Inc, a brand of Mestek, Inc: www.louvers-dampers.com/#sle.
   2. Nailor Industries, Inc: www.nailor.com/#sle.

3. Ruskin Company: www.ruskin.com/#sle.
4. Greenheck Fan Corporation.
5. Pottorff: www.pottorff.com/#sle.
6. Vent Products Company, Inc.
7. Substitutions: See Section 23 0500 - HVAC General Provisions.

B. Standard, Galvanized Steel, Manual Volume Dampers:
1. Suitable for horizontal or vertical applications.
2. Single blade, or multiple, opposed-blade design.

C. Adjustable quadrants or regulators: Plainly marked to indicate position of damper, with locking nut.

2.03 BACKDRAFT DAMPERS - METAL

A. Manufacturers:
1. Louvers & Dampers, Inc, a brand of Mestek, Inc: www.louvers-dampers.com/#sle.
2. Nailor Industries, Inc: www.nailor.com/#sle.
3. Ruskin Company: www.ruskin.com/#sle.
4. Greenheck Fan Corporation.
5. Pottorff: www.pottorff.com/#sle.
6. Vent Products Company, Inc.
7. Substitutions: See Section 23 0500 - HVAC General Provisions.

B. Gravity Backdraft Dampers, Size 18 by 18 inches 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 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.

2.04 DUCT ACCESS DOORS

A. Manufacturers:
1. Ductmate Industries, Inc, a DMI Company: www.ductmate.com/#sle.
2. Nailor Industries, Inc: www.nailor.com/#sle.
3. Ruskin Company: www.ruskin.com/#sle.
4. Greenheck Fan Corporation.
5. MIFAB.
6. Substitutions: See Section 23 0500 - HVAC General Provisions.

B. Fabrication: Rigid and close fitting of galvanized steel with sealing gaskets and quick-fastening locking devices. For insulated ducts, install minimum 1-inch thick insulation with sheet metal cover.
1. Less Than 12 inches Square: Secure with sash locks.
2. Up to 18 inches Square: Provide two hinges and two sash locks.
3. Up to 24 by 48 inches: Three hinges and two compression latches with outside and inside handles.
4. Larger Sizes: Provide an additional hinge.

C. Access doors with sheet metal screw fasteners are not acceptable.

2.05 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.

2.06 FLEXIBLE DUCT CONNECTORS

A. Manufacturers:
   1. Carlisle HVAC Products; Dynair Connector Plus G90 Steel Offset Seam Neoprene Fabric: www.carlislehvac.com/#sle.
   2. Ductmate Industries, Inc, a DMI Company: www.ductmate.com/#sle.
   3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
   4. Substitutions: See Section 23 0500 - HVAC General Provisions.

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

C. Flexible Duct Connections: Fabric crimped into metal edging strip.
   1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz/sq yd.
      a. Net Fabric Width: Approximately 6 inches wide.
   2. Metal: 3 inches wide, 24 gauge, 0.0239 inch thick galvanized steel.

D. Maximum Installed Length: 14 inch.

2.07 VOLUME CONTROL DAMPERS

A. Products for Automatic Controls: See Section 25 3523.

B. Manufacturers:
   1. Louvers & Dampers, Inc, a brand of Mestek, Inc: www.louvers-dampers.com/#sle.
   2. MKT Metal Manufacturing: www.mktduct.com/#sle.
   3. Nailor Industries, Inc: www.nailor.com/#sle.
   4. NCA, a brand of Metal Industries Inc: www.ncamfg.com/#sle.
   5. Ruskin Company: www.ruskin.com/#sle.
   6. Greenheck Fan Corporation.
   7. Vent Products Company, Inc.
   8. Substitutions: See Section 23 0500 - HVAC General Provisions.

C. Fabricate in accordance with SMACNA (DCS) and as indicated.

D. Single Blade Dampers:
   1. Fabricate for duct sizes up to 6 by 30 inch.
   2. Blade: 24 gauge, 0.0239 inch, minimum.

E. Multi-Blade Damper: Fabricate consisting of opposed blades with maximum blade sizes 8 by 72 inches. Assemble center- and edge-crimped blades in prime-coated or galvanized-channel frame with suitable hardware.
   1. Blade: 18 gauge, 0.0478 inch, minimum.

F. Quadrants:
   1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
   2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
   3. Where rod lengths exceed 30 inches provide regulator at both ends.

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 23 3100 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, adjusting, and cleaning at the following locations and elsewhere as indicated:

1. Upstream of duct coils.
2. Downstream from control dampers and backdraft dampers.
3. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links.
4. Downstream from humidifiers. Include vision panel.
5. Provide minimum 12" by 12" size access door for hand and shoulder access, or as indicated on drawings.
6. Label access doors to indicate purpose of access.

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. 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.

H. 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.

3.03 FIELD QUALITY CONTROL

A. Operate dampers to verify full range of movement.

B. Inspect locations of access doors and verify that purpose of access door can be performed.

END OF SECTION

SECTION 23 3423 - HVAC POWER VENTILATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Roof exhausters.

B. Cabinet exhaust fans.

1.02 REFERENCE STANDARDS

A. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program; 2015.

B. AMCA 99 - Standards Handbook; 2016.

C. AMCA 204 - Balance Quality and Vibration Levels for Fans; 2020.

D. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating; 2016, with Errata (2018).

E. AMCA 300 - Reverberant Room Method for Sound Testing of Fans; 2014.

F. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; 2022.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate fan roof curbs and service utilities installation according to fan size.

1.04 SUBMITTALS

A. See Section 01 3000 - 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. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Carnes, a division of Carnes Company Inc: www.carnes.com/#sle.

B. Greenheck Fan Corporation: www.greenheck.com/#sle.

C. Loren Cook Company: www.lorencook.com/#sle.

D. PennBarry, Division of Air System Components: www.pennbarry.com/#sle.

E. Twin City Fan & Blower: www.tcf.com/#sle.

F. Greenheck Fan Corporation: www.greenheck.com/#sle.

G. Captive-Aire.

H. Substitutions: See Section 23 0500 - HVAC General Provisions.

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 ROOF EXHAUSTERS

A. Fan Unit: V-belt or direct driven as indicated, with spun aluminum housing; resilient mounted motor; 1/2 inch mesh, 0.62 inch thick aluminum wire birdscreen; square base to suit roof curb with continuous curb gaskets.

B. Roof Curb: 16 inch high self-flashing of galvanized steel with continuously welded seams, built-in cant strips.

C. Disconnect Switch: Factory wired, nonfusible, in housing for thermal overload protected motor and wall mounted multiple speed switch.

D. Backdraft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked, and line voltage motor drive, power open, spring return.

E. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm gets attained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

2.04 CABINET EXHAUST FANS

A. Manufacturers:
   1. Broan-NuTone, LLC; ____: www.broan-nutone.com/#sle.
   2. Carnes, a division of Carnes Company Inc: www.carnes.com/#sle.
   3. Greenheck Fan Corporation: www.greenheck.com/#sle.
   4. PennBarry, Division of Air System Components: www.pennbarry.com/#sle.
   5. Twin City Fan & Blower: www.tcf.com/#sle.
   6. Substitutions: See Section 23 0500 - HVAC General Provisions.

B. Centrifugal Fan Unit: V-belt or direct driven with galvanized steel housing, resiliently mounted motor, gravity backdraft damper in discharge.

C. Disconnect Switch: Cord and plug-in housing for thermal overload protected motor and wall mounted switch.

D. Grille: Molded white plastic.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Secure roof exhausters with cadmium plated steel lag screws to roof curb.

C. Extend ducts to roof exhausters into roof curb. Counterflash duct to roof opening.

D. Hung Cabinet Fans:
   1. Install flexible connections between fan and ductwork; see Section 23 3300. Ensure metal bands of connectors are parallel with minimum 1 inch flex between ductwork and fan while running.

E. Provide sheaves required for final air balance.

F. Install backdraft dampers on inlet to roof and wall exhausters.

G. Provide backdraft dampers on outlet from cabinet and ceiling exhauster fans and as indicated.

END OF SECTION

SECTION 23 3439 - HIGH-VOLUME, LOW-SPEED PROPELLER FANS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. High-volume, low-speed propeller fans.

1.02 RELATED REQUIREMENTS

A. Section 23 0513 - Common Motor Requirements for HVAC Equipment.

1.03 REFERENCE STANDARDS

A. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

B. UL 507 - Electric Fans; Current Edition, Including All Revisions.

1.04 SUBMITTALS

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

B. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and electrical characteristics and connection requirements.

C. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.05 FIELD CONDITIONS

A. Fans may not be used for ventilation during construction.

1.06 WARRANTY

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

B. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 507.

B. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

2.02 HIGH-VOLUME, LOW-SPEED PROPELLER FANS

A. Manufacturers:

1. Big Ass Fans; Basic 6: www.bigassfans.com/#sle.
2. Hunter Fan International: www.hunterfan.com/#sle.
3. Patterson Fan Company, Inc: www.pattersonfan.com/#sle.
4. Substitutions: See Section 23 0500 - HVAC General Provisions.

B. Mounting Options: Ceiling.

C. Direct Drive Fan:

1. Statically and dynamically balanced.
2. Motors:
    a. Open drip-proof (ODP).
    b. Heavy duty ball bearing type.

c. Mount on vibration isolators or resilient cradle mounts, out-of-airstream.
d. Fully accessible for maintenance.

D. Shafts and Bearings:
1. Fan Shaft:
a. Ground and polished steel with anti-corrosive coating.
b. First critical speed at least 25 percent over maximum cataloged operating speed.
2. Bearings:
a. Permanently sealed or pillow block type.
b. Minimum L10 life in excess of 100,000 hours (equivalent to L50 average life of 500,000 hours), at maximum cataloged operating speed.
c. 100 percent factory tested.

E. Disconnect Switches:
1. Factory mounted and wired.
2. NEMA EN 10250 Enclosure: Unless otherwise indicated, as specified for the following installation locations:
a. Indoor Clean, Dry Locations: Type 1.
b. Outdoor Locations: Type 3R.
3. Finish for Painted Steel Enclosures: Provide manufacturer's standard or factory applied gray unless otherwise indicated.
4. Positive electrical shutoff.
5. Wired from fan motor to junction box installed within motor compartment.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Secure fan with stainless steel lag screws to structure.
C. Ceiling-Mounted Fans:
1. Install fans with resilient mountings and flexible electrical leads. See Section 23 0548.

END OF SECTION

SECTION 23 3600 - AIR TERMINAL UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Single-duct terminal units.
   1. Constant-volume units.
   2. Variable-volume units.

1.02 RELATED REQUIREMENTS

A. Section 23 0548 - Vibration and Seismic Controls for HVAC.
B. Section 23 3100 - HVAC Ducts and Casings.

1.03 REFERENCE STANDARDS

A. AHRI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils; 2001, with Addenda (2011).
B. AHRI 880 (I-P) - Performance Rating of Air Terminals; 2017.
C. ASTM A492 - Standard Specification for Stainless Steel Rope Wire; 1995 (Reapproved 2019).
D. ASTM A603 - Standard Specification for Metallic-Coated Steel Structural Wire Rope; 2019.
E. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material); 2019.
F. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.
G. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems; 2008.
H. UL 94 - Tests for Flammability of Plastic Materials for Parts in Devices and Appliances; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Product Data: Provide data indicating configuration, general assembly, and materials used in fabrication. Include catalog performance ratings that indicate airflow, static pressure, and NC designation. Include electrical characteristics and connection requirements.
C. Shop Drawings: Indicate configuration, general assembly, and materials used in fabrication, and electrical characteristics and connection requirements.
D. Project Record Documents: Record actual locations of units and locations of access doors required for access of valving.
E. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts lists. Include directions for resetting constant-volume regulators.
F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 WARRANTY

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

PART 2 PRODUCTS

2.01 SINGLE-DUCT, VARIABLE-VOLUME AND CONSTANT-VOLUME UNITS

A. Manufacturers:

1. Krueger-HVAC: www.krueger-hvac.com/#sle.
2. Metalaire, a brand of Metal Industries Inc: www.metalaire.com/#sle.
3. Price Industries, Inc: www.priceindustries.com/#sle.
4. Trane, a brand of Ingersoll Rand: www.trane.com/#sle.
5. Tuttle and Bailey: www.tuttleandbailey.com/#sle.
6. Titus, a brand of Air Distribution Technologies: www.titus-hvac.com/#sle.
7. Carnes, a division of Carnes Company Inc: www.carnes.com/#sle.
8. Nailor Industries Inc: www.nailor.com/#sle.
9. Substitutions: See Section 23 0500 - HVAC General Provisions.

B. General:
1. Factory-assembled, AHRI 880 (I-P) rated and bearing the AHRI seal, air volume control terminal with damper assembly, flow sensor, externally mounted volume controller, duct collars, and all required features.
2. Control box bearing identification, including but not necessarily limited to nominal cfm, maximum and minimum factory-set airflow limits, coil type and coil (right or left hand) connection, where applicable.

C. Unit Casing:
1. Minimum 22 gauge, 0.0299 inch galvanized steel.
2. Air Inlet Collar: Provide round, suitable for standard flexible duct sizes.
3. Unit Discharge: Rectangular, with slip-and-drive connections.
4. Acceptable Liners:
   a. 1/2 inch thick, coated, fibrous-glass complying with ASTM C1071.
      1) Secure with adhesive.
      2) Coat edges exposed to airstream with NFPA 90A approved sealant.
      3) Cover liner with non-porous foil.
   b. Liner not to contain pentabrominated diphenyl ether (CAS #32534-81-9) or octabrominated diphenyl ether.

D. Damper Assembly:
1. Heavy-gauge, galvanized steel, or extruded aluminum construction with solid steel, nickel-plated shaft pivoting on HDPE, self-lubricating bearings.
2. Provide integral position indicator or alternative method for indicating damper position over full range of 90 degrees.
3. Incorporate low leak damper blades for tight airflow shutoff.

E. Hot Water Heating Coil:
1. Coil Casing: Minimum 22 gauge, 0.0299 inch galvanized steel, factory-installed on terminal discharge with rectangular outlet, duct connection type.
2. Coil Fins: Aluminum or aluminum plated fins, mechanically-bonded to seamless copper tubes.
3. Coil leak tested to minimum 350 psig.
4. Base performance data on tests run in accordance with AHRI 410 and units to bear AHRI 410 label.

F. Controls:
1. By ATC.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install the inlets of air terminal units and air flow sensors a minimum of four duct diameters from elbows, transitions, and duct takeoffs.
C. Provide ceiling access doors or locate units above easily removable ceiling components.
D. Support units individually from structure with wire rope complying with ASTM A492 and ASTM A603 in accordance with SMACNA (SRM). See Section 23 0548.
E. Do not support from ductwork.
F. Connect to ductwork in accordance with Section 23 3100.
G. Install piping adjacent to air terminal unit to allow service and maintenance.
H. Hot-Water Piping: Connect heating coils to supply with shutoff valve, strainer, control valve, and union or flange; and to return with balancing valve and union or flange.
I. Maintain required electrical clearances in front of control boxes.

3.02 CLEANING

A. Vacuum clean coils and inside of units.

END OF SECTION

SECTION 23 3700 - AIR OUTLETS AND INLETS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Diffusers
B. Rectangular ceiling diffusers.
C. Round ceiling diffusers.
D. Slot ceiling diffusers.
E. Registers/grilles:
    1. Floor-mounted, linear supply register/grilles.
    2. Ceiling-mounted, egg crate exhaust and return register/grilles.
    3. Ceiling-mounted, exhaust and return register/grilles.
    4. Ceiling-mounted, supply register/grilles.
    5. Wall-mounted, supply register/grilles.
    6. Wall-mounted, exhaust and return register/grilles.
F. Duct-mounted supply and return registers/louvers.
G. Louvers:
H. Goosenecks.
I. Gravity ventilators.

1.02 REFERENCE STANDARDS

A. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.
B. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

1.03 SUBMITTALS

A. See Section 01 3000 - 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.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Carnes, a division of Carnes Company Inc: www.carnes.com/#sle.
B. Krueger-HVAC: www.krueger-hvac.com/#sle.
C. Price Industries: www.price-hvac.com/#sle.
D. Titus, a brand of Air Distribution Technologies: www.titus-hvac.com/#sle.
E. Tuttle and Bailey: www.tuttleandbailey.com/#sle.
F. Nailor Industries Inc: www.nailor.com/#sle.
G. Hart & Cooley, Inc.
H. Shoemaker.
I. Substitutions: See Section 23 0500 - HVAC General Provisions.

2.02 ROUND CEILING DIFFUSERS

A. Type: Round, adjustable pattern, stamped or spun, multicore diffuser to discharge air in 360-degree pattern, with sectorizing baffles where indicated. Project diffuser collar not more than 1 inch above ceiling. In plaster ceilings, provide plaster ring and ceiling plaque.

B. Fabrication: Steel with baked enamel finish.

C. Color: As indicated on drawings.

D. Accessories: As indicated on the drawings.

2.03 RECTANGULAR CEILING DIFFUSERS

A. Type: Provide square formed adjustable, backpan stamped, and core removable ceiling diffusers constructed to maintain 360 degree discharge air pattern with sectorizing baffles where indicated.

B. Connections: Round.

C. Frame: Provide surface mount and inverted T-bar type as scheduled. In plaster ceilings, provide plaster frame and ceiling frame.

D. Fabrication: Steel with baked enamel finish.

E. Color: As indicated on drawings.

F. Accessories: As indicated on drawings.

2.04 CEILING SLOT DIFFUSERS

A. Type: Continuous slot, with adjustable vanes for left, right, or vertical discharge.

B. Fabrication: Aluminum extrusions with factory baked enamel finish.

C. Color: As indicated on the drawings.

D. Plenum: Integral, galvanized steel, insulated.

1. Provide sloped shoulder for 10 foot ceilings or lower.
2. Provide square shoulder for ceilings higher than 10 feet.

E. Accessories: As indicated on the Drawings and as follows.

1. Mitered Corners: where required
2. Blank off: where required
3. Alignment strips: where multiple sections are to be assembled to appear as one continuous diffuser.
4. Plaster Frame Spacers: where installed in plaster frame
5. Field Cut Diffusers: provide diffusers 6” longer than specified to allow the diffuser to be cut in the field. Field cutting shall be specified where a continuous run of diffusers is required.
6. Equalizing Core: where installed on spiral ducts.

2.05 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.

C. Color: As indicated on drawings.

2.06 CEILING SUPPLY REGISTERS/GRILLES

A. Type: Streamlined and individually adjustable curved blades to discharge air along face of grille, one-way deflection.

B. Frame: As indicated on drawings.

C. Construction: Made of steel or aluminum extrusions with factory enamel finish.

D. Color: As indicated on drawings.

E. Accessories: As indicated on drawings.

1. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.

2.07 CEILING EXHAUST AND RETURN REGISTERS/GRILLES

A. Type: Streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, with blades set at 45 degrees, vertical face.

B. Frame: As indicated on drawings.

C. Fabrication: Steel with 20 gauge, 0.0359 inch minimum frames and 22 gauge, 0.0299 inch minimum blades, steel and aluminum with 20 gauge, 0.0359 inch minimum frame, or aluminum extrusions, with factory baked enamel finish.

D. Color: As indicated on the drawings.

E. Accessories: As indicated on drawings.

1. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face where not individually connected to exhaust fans.

2. Gymnasiums: Provide front pivoted or welded in place blades, securely fastened to be immobile.

2.08 CEILING EGG CRATE EXHAUST AND RETURN GRILLE

A. Type: Egg crate style face consisting of 1/2 by 1/2 by 1/2 inch grid core.

B. Fabrication: Grid core consists of aluminum with mill aluminum finish.

C. Color: As indicated on the drawings.

D. Accessories: Provide integral gang and face operated opposed blade damper, as indicated on drawings.

2.09 WALL SUPPLY REGISTERS/GRILLES

A. Type: Streamlined and individually adjustable blades, 3/4 inch minimum depth, 3/4 inch maximum spacing with spring or other device to set blades, vertical face, single deflection.

B. Frame: 1-1/4 inch margin with countersunk screw mounting and gasket.

C. Fabrication: Steel with 20 gauge, 0.0359 inch minimum frames and 22 gauge, 0.0299 inch minimum blades, steel and aluminum with 20 gauge, 0.0359 inch minimum frame, or aluminum extrusions, with factory baked enamel finish.

D. Color: As indicated on the drawings.

E. Damper: Integral, gang-operated opposed blade type with removable key operator, operable from face.

F. Gymnasiums: Provide front pivoted or welded in place blades, securely fastened to be immobile.

2.10 WALL EXHAUST AND RETURN REGISTERS/GRILLES

A. Type: Streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, with spring or other device to set blades, vertical face.

B. Frame: 1-1/4 inch margin with countersunk screw mounting.

C. Fabrication: Steel frames and blades, with factory baked enamel finish.

D. Color: As indicated on the drawings.

E. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.

2.11 LINEAR FLOOR SUPPLY REGISTERS/GRILLES

A. Frame: 1-1/4 inch heavy margin frame with countersunk screw mounting, and mounting frame.
B. Fabrication: Aluminum extrusions with factory baked enamel finish.
C. Color: To be selected by Architect from manufacturer's standard range.
D. Damper: Integral gang-operated opposed blade damper with removable key operator, operable from face.
E. Heavy duty floor grilles: Include a removable core.

2.12 LOUVERS

A. Manufacturers:
   1. NCA, a brand of Metal Industries Inc: www.ncamfg.com/#sle.
   2. Ruskin Company: www.ruskin.com/#sle.
   3. Airolite Company, LLC (The)..
   4. American Warming and Ventilating, Inc.; a Mestek company.
   5. Arrow United Industries; a division of Mestek, Inc.
   6. Greenheck Fan Corporation.
   7. Industrial Louvers, Inc.
   8. Nailor Industries, Inc.
   9. Pottorff.
   10. Substitutions: See Section 23 0500 - HVAC General Provisions.
B. Type: 6 inch deep frame with blades on 45 degree slope with center baffle and return bend, heavy channel frame, 1/2 inch square mesh screen over intake or exhaust end.
   1. Intake Louver Blades: Additional offset or “rain hook” for extra protection against water penetration.
C. Fabrication: 16 gauge, 0.0598 inch (1.52 mm) thick galvanized steel thick galvanized steel welded assembly, with factory prime coat finish.
D. Color: To be selected by Architect from manufacturer's standard range.
E. Mounting: Furnish with interior flat flange for installation.

2.13 GOOSENECKS

A. Fabricate in accordance with of minimum 18 gauge, 0.0598 inch galvanized steel.
B. Mount on minimum 12 inch high curb base where size exceeds 9 by 9 inch.

2.14 GRAVITY VENTILATORS

A. Hood Intake and Relief Gravity Ventilator:
   1. Manufacturers:
      a. American Coolair Corporation: www.coolair.com/#sle.
      b. Greenheck Fan Corporation: www.greenheck.com/#sle.
      c. Loren Cook Company: www.lorencook.com/#sle.
      d. Substitutions: See Section 23 0500 - HVAC General Provisions.
   2. General:
      a. Low silhouette for intake applications with natural gravity or negative pressure system(s).
      b. Suitable for non-ducted applications.
      c. Equipment to bear permanently affixed manufacturer's nameplate listing model and serial number.
   3. Hood and Base:

a. Material: Aluminum.
b. Hood Construction: Precision formed, arched panels with interlocking seams.
c. Vertical End Panels: Fully locked into hood end panels.
d. Curb Cap: Pre-punched mounting holes for installation.

4. Birdscreen:
   a. Construction: 1/2 inch Galvanized mesh.
   b. Horizontally mounted across hood intake area.
5. Hood Support: Galvanized steel construction and fastened so hood can be removed completely from base or hinged open.
6. Options/Accessories:
   a. Roof Curbs:
      1) Mounted on roof with fan.
      2) Material: Aluminum.
      3) Insulation Thickness: 1 inch.
   b. Curb Seal: Rubber seal between fan and roof curb.
   c. Dampers:
      1) Intake Type: Motorized.
      2) Exhaust Type: Gravity.
      3) Factory designed to prevent outside air from entering back into building when fan is off.
      4) Balanced for minimal resistance to flow.
      5) Galvanized frames with pre-punched mounting holes.
   d. Factory Finish: Thermo-setting polyester urethane.

B. Spun Aluminum Intake and Relief Gravity Ventilator:
1. Manufacturers:
   a. American Coolair Corporation: www.coolair.com/#sle.
   b. Greenheck Fan Corporation: www.greenheck.com/#sle.
   c. Loren Cook Company: www.lorencook.com/#sle.
   d. Substitutions: See Section 23 0500 - HVAC General Provisions.
2. General:
   a. Provide low silhouette configuration for intake applications with natural gravity or negative pressure system.
   b. Suitable for non-ducted applications.
   c. Equipment to bear permanently affixed manufacturer's nameplate listing model and serial number.
3. Hood:
   a. Material: Aluminum.
   b. Internal structure constructed of galvanized steel.
4. Birdscreen:
   a. Construction: 1/2 inch galvanized mesh.
   b. Horizontally mounted across hood intake area.
5. Housing:
   a. Curb Cap:
      1) Construction: Aluminum.
      2) Integral deep spun inlet venturi with pre-punched mounting holes to ensure correct attachment to roof.

b. Windband:
    1) One piece spun aluminum construction with uniform, original material thickness throughout housing.
    2) Include integral rolled bead for strength.

6. Options/Accessories:
    a. Roof Curbs:
        1) Flat Roofs:
            (a) Welded, straight side curb with flashing flange and wood nailer.
        2) Mounted upon roof with fan.
        3) Material: Aluminum.
        4) Insulation Thickness: 1 inch.
    b. Curb Seal: Rubber seal between fan and roof curb.
    c. Dampers:
        1) Intake Type: Motorized.
        2) Exhaust Type: Gravity.
        3) Factory designed to prevent outside air from entering back into building when fan is off.
        4) Balanced for minimal resistance to flow.
        5) Galvanized frames with pre-punched mounting holes.
    d. Flashing Flange:
        1) Construction:
            (a) Aluminum.

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.

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 23 5216 - 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.
F. Electrical power.

1.02 RELATED REQUIREMENTS

A. Section 23 0913 - Instrumentation and Control Devices for HVAC.
B. Section 25 1500 - Integrated Automation Software.

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. ASME BPVC-IV - Boiler and Pressure Vessel Code, Section IV - Rules for Construction of Heating Boilers; 2023, with Errata (2024).
E. NBBI Manufacturer and Repair Directory - The National Board of Boiler and Pressure Vessel Inspectors (NBBI); Current Edition.
F. NFPA 54 - National Fuel Gas Code; 2024.
G. 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 01 3000 - 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. Manufacturer's Field Reports: Burner manifold gas pressure, percent carbon monoxide (CO), percent oxygen (O), percent excess air, flue gas temperature at outlet, ambient temperature, net stack temperature, percent stack loss, percent combustion efficiency, and heat output.
E. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, cleaning procedures, replacement parts list, and maintenance and repair data.
F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.06 WARRANTY

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

B. Provide a five year warranty to include coverage for heat exchanger.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Natural Gas for Indoor Applications:

1. LAARS Heating Systems Company: www.laars.com/#sle.
2. Lochinvar LLC: www.lochinvar.com/#sle.
3. The Fulton Companies: www.fulton.com/#sle.
4. PK
5. RBI
6. Thermal Solutions.
7. Substitutions: See Section 23 0500 - HVAC General Provisions.

B. Approved Substitiutions:

1. It is the sole responsibility of the installing Contractor to ensure that any substituted equipment is equivalent in fit, form and function to the scheduled and specified equipment.
2. Installing Contractor shall verify the boiler pump pressure loss and flow. Provide pumps, all electrical wiring and electrical accessories to ensure a fully operable system.
3. All costs for additional work caused by the substitution of equipment shall be borne by the Contractor.

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.

1. Headers: Gaskets, bolts, and o-rings are not acceptable.

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.

H. Boiler shall be capable of operation with any jacket panels removed.

2.04 BOILER TRIM

A. ASME rated pressure relief valve set at 30 psi.

B. Flow switch for low flow protection.

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: Operating pressure and temperature ranges so normal operating range is about 50 percent of full range.

E. Pressure Switches:

1. High gas pressure.
2. Low gas pressure.
3. Air pressure.

F. Manual reset high limit, adjustable.

G. Drain Valve: Minimum 3/4” hose-end gate valve.

H. Manufacturer condensate neutralization kit with condensate piping from boiler to nearest building drain. Provide one per boiler unless otherwise indicated on the Drawings.

I. Provide barometric dampers as required for common vented boilers.

J. 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, integral to boiler, designed to burn natural gas and propane, 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 scheduled combustion efficiency and scheduled turndown. Minimum turndown of 3:1 and maximum turndown of 10:1.
3. Combustion Air Filter: Protects fuel burning system from debris. Replaceable or washable. Provide additional filter to owner at project completion.

B. Gas Train: Plug valve, safety gas valve, gas-air ratio control valve, and pressure regulator controls air and gas mixture.

1. Ignition: Silicone carbide hot-surface ignition or electric spark-to-pilot ignition that includes flame safety supervision and 100 percent main-valve shutoff.

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.

2.07 ELECTRICAL POWER

A. See the schedule on the Drawings for electrical input to the boiler.

B. The boiler shall include factory mounted and wired transformer and fuses to allow for a single point power connection.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Wall-mounted Equipment: Provide AC Plywood, 3/4” or 5/8” thickness, painted both sides with fireproof paint, color to be determined and coordinated with owner. Paint is required even if installed on a non-fire rated wall.

C. Install boiler and provide connection of natural gas service in accordance with requirements of NFPA 54 and applicable codes.

D. Install boiler on concrete housekeeping base, sized minimum of 6 inches larger than boiler base in accordance with Section 03 3000.

1. Coordinate sizes and locations of concrete bases with actual equipment provided.
2. Construct concrete bases 4 inches high.

E. Coordinate factory installed controls with Section 23 0913.

F. Pipe relief valves to nearest floor drain.

G. 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.

H. Provide piping connections and accessories as indicated.

I. Arrange all electrical conduit, piping, exhaust vent, and air intake with clearances for burner removal and service of all equipment.

J. Coordinate BAS, BMS, or Integrated Automation linking between unit controller(s) and remote front-end interface; see Section 25 1500.

3.02 SYSTEM STARTUP

A. Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.

B. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

C. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation.

D. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.03 CLOSEOUT ACTIVITIES

A. Demonstrate proper operation of equipment to Owner's designated representative.

END OF SECTION

SECTION 23 5533 - FUEL-FIRED UNIT HEATERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Gas fired unit heaters.

B. Tubular infrared heaters.

1.02 RELATED REQUIREMENTS

A. Section 23 0513 - Common Motor Requirements for HVAC Equipment: Fan motors.

B. Section 23 5100 - Breechings, Chimneys, and Stacks.

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.

C. NFPA 54 - National Fuel Gas Code; 2024.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

F. NFPA 211 - Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances; 2024.

G. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 SUBMITTALS

A. See Section 01 3000 - 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. Shop Drawings: Indicate assembly, required clearances, and locations and sizes of field connections.

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.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements - Project Requirements, for additional provisions.

1.05 WARRANTY

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

B. Provide five year manufacturers warranty for heat exchangers.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Comply with NFPA 70.

B. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified and indicated.

2.02 GAS FIRED UNIT HEATERS

A. Manufacturers:
   1. Modine Manufacturing Company: www.modine.com/#sle.
   2. Sterling HVAC/Mestek Technology, Inc: www.sterlinghvac.com/#sle.
   3. Reznor/Thomas & Betts Corporation: www.reznorhvac.com/#sle.
   4. Lennox Industries, Inc..
   5. Substitutions: See Section 23 0500 - HVAC General Provisions.

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.
   3. Limit Control: Fixed stop at maximum permissible setting, de-energizes burner on excessive bonnet temperature, automatic resets.

H. Requirements:
   1. Equipped with power venting.
   2. Concentric, Terminal Vent Assembly: Combined combustion-air inlet and power-vent outlet with wall or roof caps. Include adapter assembly for connection to inlet and outlet pipes and flashing for wall or roof penetration.

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.

2.03 TUBULAR INFRARED HEATERS

A. Manufacturers:
   1. Detroit Radiant Products Company: www.reverberay.com/#sle.
   2. Space-Ray, Division of Gas Fired Products, Inc.
   3. Reznor/Thomas & Betts Corporation: www.reznorhvac.com/#sle.
   4. Roberts Gordon.
   5. Schwank.
   6. Substitutions: See Section 23 0500 - HVAC General Provisions .

B. Infrared Heaters: Tubular type; packaged, partially factory assembled, pre-wired unit consisting of cabinet, burner, heat exchanger, radiant tube, reflector, controls; for natural gas.

C. Heat Exchanger: Aluminized tubular steel combustion chamber with aluminized steel tube with aluminum reflector.

D. Gas Burner:

1. Gas Burner: Forced draft type with adjustable combustion air supply.
2. Gas valve 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.
4. Non-corrosive burner air blower with permanently lubricated motor.

E. Gas Burner Safety Controls: Thermo-couple sensor prevents opening of solenoid gas valve until pilot flame is proven and stops gas flow on ignition failure.

F. Operating Controls: Low voltage room thermostat cycles burner to maintain room temperature setting.

G. Performance:

1. Refer to Schedule. Gas heating capacities are sea level ratings.

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 23 5100.

3.03 INFRARED HEATERS

A. Suspended units: suspend from substrate using chain hanger kits and building attachments.

B. Adhere to manufacturers' installation instructions. Maintain manufacturers' published clearances to combustibles.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Replace damaged and malfunctioning controls and equipment.

E. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain gas-fired radiant heaters.

3.04 UNIT HEATERS

A. Comply with manufacturer's product data, including technical bulletins, product catalog installation instructions

B. Install and connect gas-fired unit heaters and associated fuel and vent piping according to NFPA 54, and applicable local codes and regulations.

C. Suspended Units: Suspend from structure using threaded rods, spring or elstomeric hangers, and building attachments. Secure rods to unit hanger attachments. Adjust hangers so unit is level and plumb.

D. Controls: Install thermostats at ADA mounting height of 48 inches above floor to center of device.

1. Line voltage thermostats installed by Electrical Contractor.

E. Wiring Method: Install control wiring in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Conceal control wiring except in unfinished spaces.

3.05 CONNECTIONS

A. Drawings indicate general arrangement of gas piping, fittings, and specialties. Connect gas piping with union or flange and appliance connector valve.

B. Install piping adjacent to equipment to allow service and maintenance.

END OF SECTION

SECTION 23 7223 - 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. Roof curbs.
G. Power and controls.

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. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size; 2017, with Addendum (2022).
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 E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
G. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. See Section 01 3000 - 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 01 6000 - Product Requirements for additional provisions.
    2. Spare Parts: One of each kind of filter.

1.04 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
B. Warranty ventilator to be free from defects in material and workmanship and of all parts for period of 1-1/2 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Energy Recovery Ventilators:
    1. RenewAire: www.renewaire.com/#sle.

2. ConsERV; Dais Analytic Corp.
3. Greenheck.
4. Nu-Air Ventilation Systems, Inc.
5. Venmar.
6. Substitutions: See Section 23 0500 - HVAC General Provisions.

2.02 ENERGY RECOVERY UNITS

A. Energy Recovery Units: Provide dessicant wheel type or stationary core air-to-air exchanger; prefabricated packaged system designed by manufacturer.
   1. Access: Hinged and/or screwed access panels on front.
   2. Framing: Welded extruded aluminum tubular frame capable of supporting components and casings.
   3. Permanent name plate listing manufacturer mounted inside door near electrical panel.

2.03 CASING

A. Wall, Floor, and Roof Panels:
   1. Panels: Removable.
   2. Construction: 1 inch thick, double wall box construction, with formed edges of exterior wall overlapping formed edges of interior wall.
   3. Exterior Wall: Galvanized steel sheet.
      a. 20 gauge, 0.0359 inch galvanized steel.
   4. Interior Wall: Galvanized sheet metal.
      a. 22 gauge, 0.0299 inch galvanized sheet metal.
   5. Insulation:
      a. 1 inch 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.
   6. Roof Panel: Weatherproof.
   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.

D. Duct Connection Collars: 0.08 inches aluminum, continuously welded.

E. Weather Hood: Provide on fresh air inlet and exhaust air outlet; removable for access.
   1. Construction: ASTM A653/A653M, G90/Z275 galvanized, 20 gauge, 0.0359 inch steel sheet.
   2. Screening: Expanded aluminum bird screen.
   3. Fresh Air Weather Hood: Maintain a face velocity less than 340 feet/min.

2.04 FANS

A. Provide separate fans for exhaust and supply blowers.

B. Fans:
   1. Individually driven with a dedicated motor.

2. Backward inclined.
3. Single width, single inlet.

C. Bearings:
1. Pillow block.
2. Bearings: Permanently lubricated sealed ball bearings.
3. Rated for not less than 200,000 hours of operation with accessible greased fittings.

D. Housings: 12 gauge, 0.1046 inch aluminized steel with plenums integral to general housing and constructed to Class 1 fan standards.

E. Motors:
1. Motors: Open drip proof.
2. Efficiency: High.
3. Speed: Single.
4. Control: Constant Speed.
5. Fan Motor: UL listed and labeled.

F. Drives:
1. Fans: Belt driven.
2. Horsepower: 7.5 hp.
3. Service Factor: 1.2.

2.05 FILTERS

A. Exhaust and Fresh Air Streams: MERV 7 filters constructed to meet ASHRAE Std 52.2.

B. Filter Racks: Bolt-on rack constructed of 0.08-inch thick aluminum, minimum, with hinged side access door and snap fasteners.

C. Provide spare set of filters.

2.06 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.
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, 3 inch 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 galvanized steel.
3) Width: Maximum 6 inches.

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 U-channel frames.
4. Blades: Single skin, 16 gauge, 0.0598 inch.

C. Motorized Dampers: Provide motorized dampers at outside air inlet.
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.

2.07 ROOF CURBS

A. Curbs: Provide full perimeter roof curb fabricated from 10 gauge, 0.1345 inch aluminized steel, for units mounted on roof.
   1. Curbs: Knock-down type.
   2. Provide flat for roof deck.

2.08 POWER AND CONTROLS

A. Motor Control Panels: UL listed.
B. Include necessary motor starters, fuses, transformers and overload protection according to NFPA 70.
C. Provide single-point field connection to power supply.
D. Install wiring in accordance with NFPA 70.

PART 3 EXECUTION

3.01 INSTALLATION

A. Provide openings for suitable ductwork connection.
B. Equipment Mounting:
   1. Install floor mounted energy recovery equipment on concrete bases. Comply with requirements for concrete bases specified in Division 03.
   2. Install suspended air-to-air energy recovery equipment with continuous-thread hanger rods and elastomeric hangers of size required to support weight of energy recovery equipment.
C. Install units with clearances for service and maintenance.
D. Provide flexible duct connections at unit duct flanges.
E. Pipe drains from drain pans to nearest floor drain; use ASTM D 1785, Schedule 40 PVC pipe and solvent-welded fittings, same size as condensate drain connection.

3.02 SYSTEM STARTUP

A. Install new filters at completion of equipment installation and before testing, adjusting, and balancing.

3.03 CLEANING

A. Clean filters, air plenums, interior and exposed-to-view surfaces prior to Substantial Completion.

END OF SECTION

SECTION 23 7313 - MODULAR INDOOR CENTRAL-STATION AIR-HANDLING UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Casing construction.
B. Fan section.
C. Filter and air cleaner section.
D. Access section.
E. Controls.

1.02 RELATED REQUIREMENTS

A. Section 23 0548 - Vibration and Seismic Controls for HVAC.
B. Section 23 3413 - Axial HVAC Fans.

1.03 REFERENCE STANDARDS

A. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program; 2015.
B. AMCA 99 - Standards Handbook; 2016.
C. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating; 2016, with Errata (2018).
D. AMCA 300 - Reverberant Room Method for Sound Testing of Fans; 2014.
E. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; 2022.
F. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size; 2017, with Addendum (2022).
G. ASHRAE Std 135 - A Data Communication Protocol for Building Automation and Control Networks; 2020, with Addendum (2024).
H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
I. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.
J. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Product Data:
    1. Published Literature: Indicate dimensions, weights, capacities, ratings, gauges and finishes of materials, and electrical characteristics and connection requirements.
    2. Fans: Performance and fan curves with specified operating point clearly plotted, power, RPM.
    3. Sound Power Level Data: Fan outlet and casing radiation at rated capacity.
    4. Electrical Requirements: Power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.
C. Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements.
D. Executed Warranty: Submit documentation of final executed warranty completed in Owner's name and registered with manufacturer.

E. Manufacturer's Instructions: Include installation instructions.

F. Maintenance Data: Include instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements for additional provisions.
2. Extra Fan Belts: One set for each unit.
3. Extra Filters: One set for each unit.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept products on site in factory-fabricated protective containers, with factory-installed shipping skids and lifting lugs. Inspect for damage.

B. Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

C. Do not operate units until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

1.06 WARRANTY

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

B. Provide minimum one year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Carrier Global Corporation: www.carrier.com/#sle.

B. Daikin Applied: www.daikinapplied.com/#sle.

C. Trane Technologies, PLC: www.trane.com/#sle.

D. York, a brand of Johnson Controls International, PLC: www.york.com/#sle.

E. AAON.

F. Krueger.

G. Nortek Air Solutions.

H. Substitutions: See Section 23 0500 - HVAC General Provisions.

1. Any manufacturer that submits a Prior Approval request must provide the following at minimum: selection drawings that indicate physical size, component characteristics (CFM/HP/weight/electrical characteristics), and letter indicating current ship date from time of bid for all components.
2. The installing Contractor is responsible to ensure that any substituted equipment is equivalent in fit, form and function to the scheduled and specified equipment.
3. The cost of any additional work caused by the substitution of equipment shall be borne by the Contractor.

2.02 REGULATORY REQUIREMENTS

A. Comply with NFPA 70.

B. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified and indicated.

2.03 FAULT CURRENT PROTECTION

A. Mechanical equipment with electrical requirements of 20 amps or greater shall be marked from the manufacturer with the short-circuit current rating (SCCR) on the equipment nameplate. Minimum SCCR value shall be as listed below unless scheduled otherwise on Drawing schedules.

B. Ratings for 208/3/60 systems:

1. 20-amp current protection or less: 5,000 SCCR.
2. 40-amp current protection or less: 10,000 SCCR.
3. 150-amp current protection or less: 35,000 SCCR.
4. Above 150-amp current protection: 65,000 SCCR.

2.04 CASING CONSTRUCTION

A. Full Perimeter Base Rail:

1. Construct of galvanized steel.
2. Provide base rail of sufficient height to raise unit for external trapping of condensate drain pans.

B. Casing:

1. Construct of one piece, insulated, double wall panels.
2. Provide mid-span, no through metal, internal thermal break.
3. Construct outer panels of galvanized steel and inner panels of galvanized steel.

C. Access Doors:

1. Construction, thermal and air pressure performance same as casing.
2. Provide surface mounted handles on hinged, swing doors.

D. Unit Flooring: Construct with sufficient strength to support expected people and equipment loads associated with maintenance activities.

E. Casing Leakage: Seal joints and provide airtight access doors so that air leakage does not exceed one percent of design flow at the specified casing pressure.

F. Insulation:

1. Provide minimum thermal thickness of 12 R throughout.
2. Completely fill panel cavities in each direction to prevent voids and settling.
3. Comply with NFPA 90A.

G. Finish:

1. Indoor Units:
    a. Provide exterior, galvanized steel panels without paint.
    b. Color: Manufacturer's standard color.

2.05 FAN SECTION

A. Plenum fan array so fan section fits through doorway.

B. Performance Ratings: Determined in accordance with AMCA 210 and labeled with AMCA Certified Rating Seal.

C. Sound Ratings: AMCA 301; tested to AMCA 300 and label with AMCA Certified Sound Rating Seal.

D. Bearings: Self-aligning, grease lubricated, with lubrication fittings extended to exterior of casing with plastic tube and grease fitting rigidly attached to casing.

E. Mounting:

1. Locate fan and motor internally on welded steel base coated with corrosion resistant paint.
2. Factory mount motor on slide rails.

3. Provide access to motor, drive, and bearings through removable casing panels or hinged access doors.

F. External Motor Junction Box: Factory mount NEMA 4 external junction box and connect to extended motor leads from internally mounted motors.

G. Motor Wiring Conduit: Factory wire fan motor wiring to the unit mounted starter-disconnect, variable frequency drive, and external motor junction box.

H. Fan Accessories:

1. Discharge dampers.

I. Flexible Duct Connections:

1. For separating fan, coil, and adjacent sections.

2.06 FILTER AND AIR CLEANER SECTION

A. General: Provide filter sections with filter racks, minimum of one access door for filter removal, and filter block-offs to prevent air bypass.

B. Hi-Efficiency Filters:

1. Media: 2 inch prefilter and 4 inch closely spaced, pleated, fine fiber, hi-efficiency filter, sealed into a rigid frame, and capable of operating up to a maximum of 625 fpm without loss of efficiency and holding capacity.
2. Filter Rack: Side-access designed to hold rigid frames.
3. Minimum Efficiency Reporting Value: 13 MERV when tested in accordance with ASHRAE Std 52.2.

C. Differential Pressure Gauge:

1. Provide factory installed dial type differential pressure gauge, flush mounted with casing outer wall, and fully piped to both sides of each filter to indicate status.
2. Maintain plus/minus 5 percent accuracy within operating limits of 20 degrees F to 120 degrees F.

2.07 ACCESS SECTION

A. Provide where indicated on drawings to allow for inspection, cleaning, and maintenance of field-installed components.

B. Construct access doors same as previously specified within this Section.

2.08 CONTROLS

A. BAS, SCADA, or other Integrated Automation Link: ASHRAE Std 135 BACnet MS/TP.

B. 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. Bolt sections together with gaskets.

C. Install flexible duct connections between fan inlet and discharge ductwork and air handling unit sections. Ensure that metal bands of connectors are parallel with minimum 1 inch flex between ductwork and fan while running.

D. Install assembled unit on vibration isolators. Install isolated fans with resilient mountings and flexible electrical leads. Install restraining snubbers as indicated; see Section 23 0548. Adjust snubbers to prevent tension in flexible connectors when fan is operating.

1. Suspended Units: Suspend and brace units from structural-steel support frame using threaded steel rods and spring hangers.

E. Provide fixed sheaves required for final air balance.

F. Make connections to coils with unions or flanges.

3.02 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Final Acceptance Requirements:
   1. Use dial indicator gauges to demonstrate fan and motor are aligned.
   2. Verify compliance with specifications using vibration analysis.
   3. Maximum Vibration Levels:
      a. 0.075 inch per second at 1 times run speed and at fan/blade frequency.
      b. 0.04 inch per second at other multiples of run speed.

C. Coordination of Other Tests and Inspections:
   1. Provide access as required to accommodate timely performance.
   2. The air handler manufacturer shall coordinate with the airflow measuring device manufacturer to ensure the proper flow profile is accounted for and good flow control and measurement is achieved. The contractor shall facilitate this coordination.

3.03 SYSTEM STARTUP

A. Provide manufacturer's field representative to perform systems startup.

B. Prepare and start equipment and systems in accordance with manufacturers' instructions and recommendations.

C. Adjust for proper operation within manufacturer's published tolerances.

D. Install new filters at completion of equipment installation and before testing, adjusting, and balancing.

3.04 CLOSEOUT ACTIVITIES

A. Demonstrate proper operation of equipment to Owner's designated representative.

B. Demonstration: Demonstrate operation of system to Owner's personnel.
   1. Use operation and maintenance data as reference during demonstration.
   2. Conduct walking tour of project.
   3. Briefly describe function, operation, and maintenance of each component.

C. 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 23 7416 - PACKAGED ROOFTOP AIR-CONDITIONING UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Packaged, small-capacity, rooftop air-conditioning units.

B. Packaged, intermediate-capacity, rooftop air-conditioning units.

C. Packaged, large-capacity, rooftop air-conditioning units.

1.02 RELATED REQUIREMENTS

A. Section 23 0548 - Vibration and Seismic Controls for HVAC.

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS

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

B. Product Data: Provide capacity and dimensions of manufactured products and assemblies required for this project. Indicate electrical service with electrical characteristics and connection requirements, and duct connections.

C. Shop Drawings: Indicate capacity and dimensions of manufactured products and assemblies required for this project. Indicate electrical service with electrical characteristics and connection requirements, and duct connections.

D. Manufacturer's Instructions: Indicate assembly, support details, connection requirements, and include start-up instructions.

E. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.

F. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect units from physical damage by storing off site until roof mounting curbs are in place and ready for immediate installation of units.

1.06 WARRANTY

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

B. Provide a five year warranty to include coverage for refrigeration compressors.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Carrier Corporation: www.commercial.carrier.com/#sle.

B. Johnson Controls International, PLC: www.johnsoncontrols.com/#sle.

C. Rheem Manufacturing Company Inc: www.rheem.com/#sle.

D. Trane Technologies, PLC: www.trane.com/#sle.

E. AAON.

F. Substitutions: See Section 23 0500 - HVAC General Provisions.

1. Prior Approval Requirements: Any manufacturer submiting a Prior Approval request must provide the following at minimum: selection drawings that indicate physical size, component characteristics (CFM/HP/weight/electrical characteristics), and letter indicating current ship date from time of bid for all components.

2.02 FAULT CURRENT PROTECTION

A. Mechanical equipment with electrical requirements of 20 amps or greater shall be marked from the manufacturer with the short-circuit current rating (SCCR) on the equipment nameplate. Minimum SCCR value shall be as listed below unless scheduled otherwise on Drawing schedules.

B. Ratings for 208/3/60 systems:
   1. 20-amp current protection or less: 5,000 SCCR.
   2. 40-amp current protection or less: 10,000 SCCR.
   3. 150-amp current protection or less: 35,000 SCCR.
   4. Above 150-amp current protection: 65,000 SCCR.

2.03 PACKAGED, SMALL-CAPACITY, ROOFTOP AIR-CONDITIONING UNITS

A. General: Roof mounted units having gas burner and electric refrigeration that are 6 tons and smaller in capacity.

B. Description: Self-contained, packaged, factory assembled and prewired, consisting of cabinet and frame, supply fan, heat exchanger and burner, economizer, controls, air filters, refrigerant cooling coil and compressor, condenser coil and condenser fan.

2.04 PACKAGED, INTERMEDIATE-CAPACITY, ROOFTOP AIR-CONDITIONING UNITS

A. General: Roof mounted units having gas burner and electric refrigeration that are 7.5 tons to 25 tons in capacity, selected for 100% out

B. Description: Self-contained, packaged, factory assembled and prewired, consisting of cabinet and frame, supply fan, heat exchanger and burner, controls, air filters, refrigerant cooling coil and compressor, condenser coil and condenser fan.

2.05 PACKAGED, LARGE-CAPACITY, ROOFTOP AIR-CONDITIONING UNITS

A. General: Roof mounted units having gas burner and electric refrigeration that are 25 tons and larger in capacity.

B. Description: Self-contained, packaged, factory assembled and prewired, consisting of cabinet and frame, supply fan, return fan, heat exchanger and burner, energy recovery wheel, controls, air filters, refrigerant cooling coil and compressor, condenser coil and condenser fan.
   1. Provide a separated air stream for exhaust air from toilet rooms.

2.06 CASING

A. Cabinet: Steel with baked enamel finish, including access panels with screwdriver-operated flush, cam type fasteners. Structural members to be minimum 18 gauge, 0.0478 inch, with access doors or panels of minimum 20 gauge, 0.0359 inch.

B. Insulation: One-inch thick, neoprene-coated glass fiber with edges protected from erosion.

2.07 FANS

A. Supply and Return Fan: Backward curved plenum type, resiliently mounted with V-belt drive, and rubber isolated hinge mounted. Provide with high efficiency motor or direct drive as indicated. Isolate complete fan assembly. See Section 23 0548.

2.08 BURNERS

A. Gas Burner: Atmospheric type burner with adjustable combustion air supply, pressure regulator, gas valves, manual shut-off, intermittent spark or glow coil ignition, flame-sensing device, and automatic 100 percent shutoff pilot.

B. Gas Burner Safety Controls: Energize ignition, limit time for establishment of flame, prevent opening of gas valve until pilot flame is proven, stop gas flow on ignition failure, energize blower motor, and after airflow proven and slight delay, allow gas valve to open.

C. High Limit Control: Temperature sensor with fixed stop at maximum permissible setting, de-energize burner on excessive bonnet temperature, and energize burner when temperature drops to lower safe value.

2.09 EVAPORATOR COIL

A. Provide copper tube aluminum fin coil assembly with galvanized drain pan and connection.

B. Provide capillary tubes or thermostatic expansion valves for units of 6 tons capacity and less, and thermostatic expansion valves and alternate row circuiting for units 7.5 tons cooling capacity and larger.

2.10 CONDENSER COIL

A. Provide copper tube aluminum fin coil assembly with subcooling rows and coil guard.

B. Provide direct drive propeller fans, resiliently mounted with fan guard, motor overload protection, wired to operate with compressor. Provide high efficiency fan motors.

2.11 COMPRESSORS

A. Provide hermetic compressors, 3600 rpm maximum, resiliently mounted with positive lubrication, crankcase heater, high and low pressure safety controls, motor overload protection, suction and discharge service valves and gauge ports, and filter drier.

2.12 AIR FILTERS:

A. 2-inch thick, glass fiber disposable media in metal frames.

2.13 ROOF CURBS

A. Roof Mounting Curb: 18 inches high, galvanized steel, channel frame with gaskets, nailer strips.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that roof is ready to receive work and opening dimensions are as required by manufacturer.

B. Verify that proper power supply is available.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Mount units on factory built roof mounting curb providing watertight enclosure to protect ductwork and utility services. Install roof mounting curb level.

C. Mount units on roof mounting curb providing watertight enclosure to protect ductwork and utility services. Install roof mounting curb level.

D. Install RTU on support structure or on concrete base as indicated. Comply with requirements in Division 03 for concrete pads.

1. Equipment Mounting: Install RTU using elastomeric mounts with minimum 1/4” deflection.
2. Coordinate wall penetrations and flashing with wall construction.

E. Connect ducts to RTUs with flexible duct connectors.

F. Install condensate drain, minimum connection size, with trap and indirect connection to nearest roof drain or area drain.

3.03 SYSTEM STARTUP

A. Prepare and start equipment. Adjust for proper operation.

B. Provide manufacturer's field representative to perform systems startup.

C. Install new filters at completion of equipment installation and before testing, adjusting, and balancing.

3.04 CLOSEOUT ACTIVITIES

A. Demonstrate proper operation of equipment to Owner's designated representative.

END OF SECTION

SECTION 23 8129 - VARIABLE REFRIGERANT FLOW HVAC SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Mini-split system air conditioner.

1.02 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

PART 2 PRODUCTS

2.01 SPLIT-SYSTEM AIR CONDITIONERS

A. Description: Split-system air-conditioning units consisting of separate evaporator-fan and compressor-condenser components.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
   1. Carrier Corporation.
   2. Daikin Applied.
   3. Gree.
   4. Lennox International Inc.
   5. LG Corporation.
   6. Mitsubishi Electric & Electronics USA, Inc.
   7. Panasonic Corporation of North America.
   8. Trane; a business of American Standard companies.
   9. YORK; a Johnson Controls company.
   10. Samsung HVAC.

C. Wall-Mounted, Evaporator-Fan Components:
   1. Cabinet: Enameled steel with removable panels on front and ends in color selected by Architect, and discharge drain pans with drain connection.
   2. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 210/240.
   3. Fan: Direct drive, centrifugal.
   4. Fan Motors:
      a. Multitapped, multispeed with internal thermal protection and permanent lubrication.
      b. Enclosure Type: Totally enclosed, fan cooled.
      c. NEMA Premium (TM) efficient motors as defined in NEMA MG 1.
   5. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.

D. Air-Cooled, Compressor-Condenser Components:
   1. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.

2. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
    a. Compressor Type: Scroll.
    b. Refrigerant Charge: R-410A.
    c. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 210/240.
3. Fan: Aluminum-propeller type, directly connected to motor.
4. Motor: Permanently lubricated, with integral thermal-overload protection.
5. Low Ambient Kit: Permits operation down to 45 °F.

E. Accessories:
1. Thermostat: Wireless infrared functioning to remotely control compressor and evaporator fan, with the following features:
    a. Compressor time delay.
    b. 24-hour time control of system stop and start.
    c. Liquid-crystal display indicating temperature, set-point temperature, time setting, operating mode, and fan speed.
    d. Fan-speed selection including auto setting.
2. Automatic-reset timer to prevent rapid cycling of compressor.
3. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.
4. Drain Hose: For condensate.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that required electrical services have been installed and are in the proper locations prior to starting installation.
B. Verify that condensate piping has been installed and is in the proper location prior to starting installation.
C. Notify Engineer if conditions for installation are unsatisfactory.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Install refrigerant piping in accordance with equipment manufacturer's instructions.
C. Perform wiring in accordance with NFPA 70, National Electric Code (NEC).
D. Coordinate with installers of systems and equipment connecting to this system.
E. Connect indoor units to condensate piping.
F. Install units level and plumb.
G. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.
H. Install ground-mounted, compressor-condenser components on 4-inch-thick, reinforced concrete base that is 4 inches larger, on each side, than unit. Concrete, reinforcement, and formwork are specified in Division 03.
I. Install roof-mounted, compressor-condenser components on equipment supports specified in Division 07.

J. Install and connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Provide manufacturer's field representative to inspect installation prior to startup.

3.04 PROTECTION

A. Protect installed components from subsequent construction operations.

B. Replace exposed components broken or otherwise damaged beyond repair.

3.05 MAINTENANCE

A. See Section 01 7000 - Execution and Closeout Requirements for additional requirements.

END OF SECTION

SECTION 23 8200 - CONVECTION HEATING AND COOLING UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hydronic or steam convectors.
B. Hydronic or steam cabinet unit heaters.
C. Fan-coil units.
D. Duct-mounted coils.

1.02 RELATED REQUIREMENTS

A. Section 23 2213 - Steam and Condensate Heating Piping.
B. Section 23 2214 - Steam and Condensate Heating Specialties.
C. Section 23 3100 - HVAC Ducts and Casings.

1.03 REFERENCE STANDARDS

A. AHRI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils; 2001, with Addenda (2011).
B. AHRI 440 - Performance Rating of Room Fan-Coils; 2008.
C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
D. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.
E. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Product Data: Provide typical catalog of information including arrangements.
C. Shop Drawings:
    1. Indicate air coil and frame configurations, dimensions, materials, rows, connections, and rough-in dimensions.
    2. Submit schedules of equipment and enclosures typically indicating length and number of pieces of element and enclosure, corner pieces, end caps, cap strips, access doors, pilaster covers, and comparison of specified heat required to actual heat output provided.
D. Selection Samples: For each finish product specified, color chart representing manufacturer's full range of available colors.
E. Project Record Documents: Record actual locations of components and locations of access doors in radiation cabinets required for access or valving.
F. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.
G. Warranty: Submit manufacturer's warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
    1. See Section 01 6000 - Product Requirements for additional provisions.

1.05 WARRANTY

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

PART 2 PRODUCTS

2.01 HYDRONIC CONVECTORS

A. Manufacturers:
   1. Modine Manufacturing Company; _____: www.modineHVAC.com/#sle.
   2. Sigma Convector Enclosure Corp.; www.sigmaproducts.com/#sle
   3. Slant/Fin Corporation: www.slantfin.com/#sle.
   4. Sterling Hydronics, a Mestek Company; _____: www.sterlingheat.com/#sle.
   5. Vulcan Radiator, a Mestek Company: www.vulcanrad.com/#sle.
   6. Substitutions: See Section 23 0500 - HVAC General Provisions See Section 01 6000 - Product Requirements.

B. Heating Elements: Seamless copper tubing mechanically expanded into evenly spaced aluminum fins and cast iron headers, steel side plates and supports, factory air pressure tested at 100 psi under water, with means of adjusting pitch of element.

C. Cabinet: 16 gauge, 0.0598 inch sheet steel front and top, 18 gauge, 0.0478 inch sheet steel back and ends; exposed corners rounded; easily secured removable front panels, adequately braced and reinforced for stiffness.

D. Finish: Factory applied baked enamel of color as selected.

E. Damper: Where not thermostatically controlled, provide knob-operated internal damper at enclosure air outlet.

F. Access Doors: For otherwise inaccessible valves, provide factory-made permanently hinged access doors, 6 by 7 inch minimum size, integral with cabinet.

2.02 HYDRONIC CABINET UNIT HEATERS

A. Manufacturers:
   1. Daiken Applied; www.daikenapplied.com/products/fan-coils/unit-heaters/#sle.
   2. Modine Manufacturing Company: www.modineHVAC.com/#sle.
   3. Sigma Convector Enclosure Corp.; www.sigmaproducts.com/#sle
   4. Sterling Hydronics a Mestek Company: www.sterlingheat.com/#sle.
   5. Trane Technologies, PLC: www.trane.com/#sle.
   6. Vulcan Radiator, a Mestek Company: www.vulcanrad.com/#sle.
   7. Substitutions: See Section 23 0500 - HVAC General Provisions.

B. Provide products listed, classified, and labeled by Underwriters Laboratories Inc. (UL) or testing firm acceptable to authority having jurisdiction as suitable for purpose indicated.

C. Coils:
   1. Evenly spaced aluminum fins mechanically bonded to copper tubes.
   2. Heating Hot Water: Suitable for working temperatures up to a maximum not less than 200 degrees F.

D. Cabinet: Minimum 16 gauge, 0.0598 inch thick sheet steel front panel with exposed corners and edges rounded, easily removed panels, glass fiber insulation, integral air outlet, and inlet grilles.

E. Finish: Factory applied baked enamel of color as selected on visible surfaces of enclosure or cabinet.

F. Fans: Centrifugal forward-curved double-width wheels, statically and dynamically balanced, direct driven.

G. Motor: Tap wound multiple speed permanent split capacitor with sleeve bearings, resiliently mounted.

H. Control: Factory wired, solid state, infinite speed control, located in cabinet.

I. Filter: Easily removed, 1 inch thick glass fiber throw-away type, located to filter air before coil.

J. Electrical Characteristics: Factory wire motors and controls for a single field connection.

2.03 FAN-COIL UNITS

A. Manufacturers:
   1. Carrier Corporation: www.commercial.carrier.com/#sle.
   2. Daikin Applied: www.daikinapplied.com/#sle.
   3. Krueger-HVAC: www.krueger-hvac.com/#sle.
   4. Superior Rex; www.superiorrex.com/products/#sle
   5. Trane Technologies, PLC: www.trane.com/#sle.
   6. Substitutions: See Section 23 0500 - HVAC General Provisions.

B. Performance Data and Safety Requirements:
   1. Unit capacities certified in accordance with AHRI 440.
   2. Provide products listed, classified, and labeled by Underwriters Laboratories Inc. (UL), Intertek (ETL), or testing firm acceptable to authority having jurisdiction as suitable for purpose indicated.
   3. Insulation to comply with NFPA 90A requirements for flame spread and smoke generation.
   4. Equipment wiring to comply with requirements of NFPA 70.

C. Coils:
   1. Evenly spaced aluminum fins mechanically bonded to copper tubes.
   2. Water Coil: Suitable for working temperatures not less than 200 degrees F.

D. Horizontal Recessed Units:
   1. Ducted Units: Provide with air inlet and outlet duct collars.

E. Finish: Factory applied baked enamel of color as selected on visible surfaces of enclosure or cabinet.

F. Fans: Centrifugal forward-curved double-width wheels, statically and dynamically balanced, direct driven.

G. Motor: Tap wound multiple speed permanent split capacitor with sleeve bearings, or ECM, resiliently mounted.

H. Controls:
   1. Controls Interface:
      a. Relay board.
      b. 24-volt transformer.

I. Filter: Easily removed 1 inch thick glass fiber throw-away type, located to filter air before coil.

J. Electrical Characteristics: Factory wire motors and controls for a single field connection.

2.04 DUCT-MOUNTED COILS

A. Water Coils:
   1. Manufacturers:
      a. Carrier Corporation: www.commercial.carrier.com/#sle.
      b. Daikin Applied: www.daikinapplied.com/#sle.
      c. Greenheck Fan Corporation; www.greenheck.com/products/#sle
      d. Trane Technologies, PLC: www.trane.com/#sle.
      e. USA Coil & Air: www.usacoil.com/#sle.
      f. Johnson Controls International, PLC: www.johnsoncontrols.com/#sle.
      g. Substitutions: See Section 23 0500 - HVAC General Provisions.
   2. Coils rated and tested in accordance with AHRI 410.

3. Tubes: Material to consist of seamless copper or brass, mechanically expanded or tension wound to fins; appropriate tube joining methods based on tube material.
4. Fins: Material to consist of aluminum or copper, continuous plate type with full fin collars or individual helical finned tube type wound under tension.
5. Casing: Heavy gauge galvanized steel with mounting holes, including intermediate tube supports if required by coil design and length.
6. Headers (Manifolds): Construct of seamless copper pipe, cast iron, or nonferrous material with tube connection appropriate to header material provided.
7. Acceptable Factory Testing Methods:
    a. Perform hydrostatic testing for coils with removable headers in accordance with approved shop drawings and normally accepted means and methods.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are suitable for installation.
B. Verify that field measurements are as indicated on drawings.

3.02 INSTALLATION

A. Install in accordance with manufacturer's recommendations.
B. Install equipment exposed to finished areas after walls and ceilings are finished and painted.
C. Convectors:
    1. Coordinate to ensure correct recess size for recessed convectors.
D. Cabinet Unit Heaters:
    1. Coordinate to ensure correct recess size for recessed units.
E. Fan-Coil Units:
    1. Coordinate to ensure correct recess size for recessed units.
F. Units with Hydronic Coils:
    1. Provide with shut-off valve on supply piping and tamper-proof, balancing valve with memory stop on return piping.
    2. If not easily accessible, extend air vent to exterior surface of cabinet for ease of servicing.
    3. Provide manual air vents with stop valve for cabinet unit heaters, fan coil units, and unit heaters.
G. Air Coils:
    1. Install in ducts and casings in accordance with SMACNA (DCS).
        a. Support coil sections independent of piping and secure to duct.
        b. Arrange supports to avoid piercing drain pans.
        c. Provide airtight seals between coil and duct.
        d. See Section 23 3100.
    2. Coil Safeguards:
        a. Protect coils to prevent damage to flanges and fins.
        b. Comb out damaged fins.
    3. Install all coils level except cleanable coils with 1:50 pitch.
    4. Make connections to hydronic and steam coils with unions and flanges.
    5. Hydronic (Drainable) Coils:
        a. Connect water supply to leaving air side of coil (counterflow arrangement).

b. Provide with shut-off valve on supply piping and tamper-proof, balancing valve with memory stop on return piping.
c. Locate supply water connection on leaving air side at bottom of supply header, and return water connection at top.
d. Provide manual air vents with stop valves at high points.
    1) Install drain connections at low points of installation.
    2) See Section 23 2113 and Section 23 2114.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for additional requirements.
B. Test and inspect in accordance with manufacturer's recommendations/check list.

3.04 CLEANING

A. After construction and painting is completed, clean exposed surfaces of units.
B. Vacuum clean coils and inside of units.
C. Touch-up marred or scratched surfaces of factory-finished cabinets using finish materials furnished by the manufacturer.
D. Install new filters.

3.05 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals for closeout submittals.

3.06 PROTECTION

A. Provide finished cabinet units with protective covers during the balance of construction.

END OF SECTION

SECTION 23 8300 - RADIANT HEATING AND COOLING UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Radiant heating hydronic piping.

1.02 RELATED REQUIREMENTS

A. Section 08 3100 - Access Doors and Panels.

1.03 REFERENCE STANDARDS

A. ASTM F876 - Standard Specification for Crosslinked Polyethylene (PEX) Tubing; 2024b.

B. ASTM F1807 - Standard Specification for Metal Insert Fittings Utilizing a Copper Crimp Ring, or Alternate Stainless Steel Clamps, for SDR9 Cross-Linked Polyethylene (PEX) Tubing and SDR9 Polyethylene of Raised Temperature (PE-RT) Tubing; 2023.

C. DIN 4726 - Warm Water Surface Heating Systems and Radiator Connecting Systems - Plastics Piping Systems and Multilayer Piping Systems; 2017.

1.04 SUBMITTALS

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

B. Shop Drawings: Indicate radiant tubing, manifolds, and accessories.

C. Maintenance Data:

1. Include repair methods and parts list of components.
2. See Section 01 6000 - Product Requirements, for additional provisions.

1.05 QUALITY ASSURANCE

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 WARRANTY

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

B. Provide 5 year manufacturer's warranty for radiant heaters and piping..

PART 2 PRODUCTS

2.01 RADIANT-HEATING HYDRONIC PIPING

A. Applications:

1. Provide the following types of hydronic, radiant heating piping for the applications described:
   a. Piping in Interior Reinforced Concrete Floors: PEX.

B. Crosslinked Polyethylene (PEX) Pipe and Fittings:

1. Manufacturers:
   a. Heatlink Group Inc.: www.heatlink.com/products/application/1/category/1/#sle.
   b. Infloor Radiant Heating Inc.: www.infloor.com/products/hydronic-systems/#sle.
   c. MrPex Systems: www.mrpexsystems.com/radiant/#sle.
   d. REHAU: www.rehau.com./us-en/mechanicalplumbing/technologies/radiantallfh/#sle
   e. Uponor, Inc; _____: www.uponor.com/#sle.
   f. Viega LLC: www.viega.us/en/products.html/#sle

g. Watts Radiant, Inc.: www. watts.com/products-flow-control-solutions/pex-plumbing-radiant-heating-system/tubing-for-pex-plumbing-and-radiant-heating-systems/#sle.
h. Zurn Water, LLC: www.zurn.com./products/pex-cross-linked-polyethylene/radiant-heating-snow-melting-turf-conditioning/#sle.
i. Substitutions: See Section 01 6000 - Product Requirements.

2. Pipe Material: PEX plastic according to ASTM F876.
3. Oxygen Barrier: Limit oxygen diffusion through the tube to maximum 0.000044 grains per cu ft/day at 104 degrees F according to DIN 4726.
4. Fittings: ASTM F1807, metal insert and copper crimp rings.
   a. Copper or bronze insert fittings with copper crimp rings.
   b. Pressure/Temperature Rating: Minimum 100 psig and 180 degrees F.

C. Distribution Manifolds (Manufacturer's Standard):
1. Manifold: Minimum 1 inch, brass, copper, or stainless steel.
2. Main Shutoff Valves:
   a. Factory installed on supply and return connections.
   b. Two-piece brass or bronze body.
   c. Ball: Chrome-plated bronze.
   d. Seals: PTFE.
   e. CWP Rating: 150 psig.
   f. Maximum Operating Temperature: 225 degrees F.
3. Manual Air Vents:
   a. Body to consist of bronze or brass.
   b. Internal Parts: Nonferrous.
   c. Operator: Key furnished with valve or screwdriver bit.
   d. Inlet Connection: 1/2 inch.
   e. Discharge Connection: 1/8 inch.
   f. CWP Rating: 150 psig.
   g. Maximum Operating Temperature: 225 degrees F.
4. Balancing Valves:
   a. Body: Provide bronze, plug or globe cartridge type.
   b. Plug: EPDM.
   c. Globe Cartridge and Washer: Brass with EPDM composition washer.
   d. Seat: PTFE.
   e. Visual Flow Indicator: Flowmeter with visible indication in a clear plastic cap at top of valve.
   f. Differential Pressure Gauge Connections: Integral seals for portable meter to measure loss across calibrated orifice.
   g. Handle Style: Knob, with memory stop to retain set position if used for shutoff.
   h. CWP Rating: Minimum 125 psig.
   i. Maximum Operating Temperature: 250 degrees F.
5. Thermometers:
   a. Mounted on supply and return connections.
   b. Case: Dry type, metal or plastic, 2 inch diameter.
   c. Element: Bi-metallic coil.
   d. Movement: Mechanical, connecting element and pointer.
   e. Dial: Satin-faced, non-reflective aluminum with permanently etched scale markings.
   f. Pointer: Black metal.

g. Window: Plastic.
h. Connector: Rigid, back type.
i. Thermal System: Bi-metallic coil.
j. Accuracy: Plus or minus 1 percent of range or 1 scale division to maximum of 1.5 percent of range.

6. Mounting Brackets: Provide copper, plastic, or rubber-clad steel, where in contact with manifold.

D. Piping Specialties (Manufacturer's Standard):

1. Cable Ties:
a. Fungus-inert, self-extinguishing, one-piece, self-locking, Type 6/6 nylon cable ties.
b. Minimum Width: 1/8 inch.
c. Minimum Tensile Strength: 20 lb.
d. Temperature Range: Minus 40 degrees F to plus 185 degrees F.

PART 3 EXECUTION

3.01 EXAMINATION

A. Hydronic Radiant Heating Piping:

1. Examine surfaces and substrates to receive radiant heating piping for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
a. Ensure that surfaces and pipes in contact with radiant heating piping are free of burrs and sharp protrusions.
b. Ensure that surfaces and substrates are level and plumb.
2. Proceed with installation only after unsatisfactory conditions are corrected.

3.02 INSTALLATION

A. Install in accordance with manufacturer's recommendations.

B. Hydronic Radiant Heating Piping:

1. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.
2. Indicate piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
3. Install piping as indicated unless deviations to layout are approved on shop drawings or coordination drawings.
4. Install radiant heating piping continuous from the manifold through the heated panel and back to the manifold without piping joints in heated panels.
5. Connect radiant piping to manifold in a reverse-return arrangement.
6. Do not bend pipes in radius smaller than manufacturer's minimum bend radius dimension.
7. Install manifolds accessible locations, or install access panels to provide maintenance access as required in Section 08 3100.
8. Revise locations and elevations from those indicated as required to suit field conditions and ensure integrity of piping and as approved by Engineer.
9. Perform the following adjustments before operating the system:
a. Open valves to fully open position.
b. Check operation of automatic valves.
c. Set temperature controls so all zones call for full flow.
d. Purge air from piping.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Hydronic Radiant Heating Piping:

1. Prepare radiant heating piping for testing as follows:
    a. Open all isolation valves and close bypass valves.
    b. Open and verify operation of zone control valves.
    c. Flush with clean water and clean strainers.
2. Perform the following tests and inspections with the assistance of a factory authorized service representative:
    a. Leak Test:
        1) After installation, charge system and test for leaks.
        2) Subject piping to hydrostatic test pressure that is not less than 1.5 times the design pressure but not more than 100 psig. Apply pressure test and check freqently during floor installation to alert tubing damage.
        3) Repair leaks and retest until no leaks exist.
    b. Replace damaged and malfunctioning controls and equipment.
3. Execute, complete, and pass required radiant-heating piping tests and inspections to accept installed piping.
4. Prepare test and inspection reports.
5. Protect hydronic piping system from damage during construction.

3.04 CLEANING

A. Radiant Ceiling Panel Heaters: Remove paint splatters, other spots, dirt, and debris.

3.05 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals.

3.06 PROTECTION

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

END OF SECTION

SECTION 26 0500 – COMMON WORK RESULTS FOR ELECTRICAL

PART 1 – GENERAL

1.1 DESCRIPTION

A. Specification Format

1. These Specifications are written in imperative and abbreviated form. This imperative language of the technical sections is directed at the Contractors, unless specifically noted otherwise. Incomplete sentences shall be completed by inserting "shall", "the Contractor shall", and "shall be", and similar mandatory phrases by inference in the same manner as they are applied to notes on the Drawings. The words "shall be" shall be supplied by inference where a colon (:) is used within sentences or phrases. Except as worded to the contrary, perform all indicated requirements whether stated imperatively or otherwise.
2. Three Part Format
   a. "Part 1.0 - General": Covers those areas which relate to the Work, and which define the general administrative and technical requirements specific to a particular section.
   b. "Part 2.0 - Products": Defines, in detail, the acceptance equipment and materials to be incorporated into the Work.
   c. "Part 3.0 - Execution": Describes, in detail, the manner in which items covered by Part 2 are to be incorporated into the Work.
3. Where Codes, Specifications and Drawings are in conflict, the Contractor will be deemed to have bid the more expensive method. Refer all such discrepancies immediately to the Engineer prior to commencing related work.

B. Definitions

1. "Furnish" - Supply equipment as required by these Drawings and Specifications, delivered to the job site for installation or use by others.
2. "Install" - Fix in position for total operational use all apparatus as shown, specified or required. Provide all miscellaneous fittings and wiring supplies.
3. "Or Approved Equal" - Equipment or materials selected by Contractor subject to Engineer's acceptance.
4. "Or Equivalent" - Equipment or materials selected by Contractor matching the function and performance of equipment or materials listed.
5. "Provide" - Furnish and install in place, total and operational.
6. “Manufacturer’s Representative” – person properly trained/certified for the specific equipment and a regular employee of the Manufacturer, the Manufacturer’s Representative Agency, a third party specializing company, or the selling distributor.
7. "Substantial Completion" - The date when the project has been completed, inspected, and accepted by the Engineer and Owner.

C. Work Included

1. Provide labor, equipment and materials in connection with Work specified and shown on Drawings.
2. Work of this Division is subject to requirements of Instructions to Bidders, General Conditions, Supplementary Conditions, Division One, and all other sections of this Specification.
3. Examine site and all Contract documents prior to submittal of bid.

D. Work Installed But Furnished Under Other Directives

1. Provide service for electrically operated equipment not specified in Division 26, 27 & 28. Verify size and locations of such connections by securing all rough-in requirements from the equipment supplier.
2. Equipment requiring electrical service shall be furnished with motors, special controls and remote electrical devices as specified in other Divisions.
3. Verify extent of controls and devices furnished by referring to Divisions where Work is specified.
4. Provide disconnects, starters, control devices, thermal units, fuses, switches and all necessary power and control wiring. Include the installation of remote electrical devices furnished separately with the equipment. Provide identification for remote devices as directed by the Engineer.
5. Contractors of other Divisions providing electrically operated equipment shall verify with the Electrical Contractor the proper voltage and phase before releasing equipment for shipment.
6. Unless otherwise specified, Contractor responsible for furnishing such equipment is also responsible for setting in place.

1.2 ALTERNATES

A. General

1. The work of this Section is affected by the Alternates described in this Specification.

B. Alternate E-1

1. The Owner wishes to know in advance the possible cost to add additional site lighting.
2. Base Bid: Include the three parking lot light fixtures.
3. Under Alternate Bid E-1 on the Bid Form, state the Contract Sum to include the site pole light fixtures as keynoted on the drawings.

C. Alternate E-2

1. The Owner wishes to know in advance the possible cost to add radiant floor heat in lieu of radiant tube heaters.
2. Base Bid: Include power and connections to the radiant tube heaters as shown on the drawings.
3. Under Alternate Bid E-2 on the Bid Form, state the Contract Sum to include the electrical connections to the manifold pumps and remove the cost for connection to the tube heaters.

D. Alternate E-6

1. The Owner wishes to know in advance the possible cost to install a shooting range.
2. Base Bid: Include the general receptacles and ten (10) type F1 light fixtures equally spaced in Room A006.
3. Under Alternate Bid E-6 on the Bid Form, state the Contract Sum to include the individual range lane receptacles and service receptacle. Also include the light fixtures as shown on the drawings.

E. Alternate E-8

1. The Owner wishes to know in advance the possible cost to add additional accent lighting on the building exterior.
2. Base Bid: No work.

3. Under Alternate Bid E-8 on the Bid Form, state the Contract Sum to include the exterior linear RGBW light fixtures along the north and east face of the building. Include all drivers and wiring as required.

F. Alternate E-10

1. The Owner wishes to know in advance the possible cost to install sign monument sign
2. Base Bid: No work.
3. Under Alternate Bid E-10 on the Bid Form, state the Contract Sum to provide power connection to the sign signage. Verify exact location and circuitry requirements with signage supplier.

1.3 CONTINGENCY

A. Use contingency only on issuance of Change Orders.

B. Refer to Division 1 for the amount to include in the Electrical Bid.

C. Money remaining in contingency at close of project will be credited to the Owner by Change Order.

1.4 SUBMITTALS

A. Substitution and Prior Approval to Quote.

1. The reference to manufacturer's name and catalog or model numbers shall be interpreted as establishing a standard of quality, not as limiting competition.
2. Suppliers wishing to price material or equipment not referenced in Specifications or on Drawings shall apply in writing to Engineer for approval to quote. Electronic submittals shall be in PDF format. Include complete descriptive technical data on the proposed item consisting of: model numbers, type, size and performance characteristics. Procedure also applies to requests by Contractor. Self-addressed, stamped envelope required for return reply.
3. The request for prior approval to quote shall be received in Engineer's office no later than 192 hours (eight days) prior to bid opening. All substitute items approved for quotation will be listed in Addenda sent to all planholders in advance of bid opening.
4. Contractors choosing to use material or equipment other than those shown on Drawings or specified in detail, but approved for quotation, shall be responsible for physical dimensions and coordination. Architect, Engineer, or Owner will not be responsible for costs of necessary changes and additional work required by Contractor or any other trades.
5. Substitutions will not be permitted after bid opening.

B. Correspondence

1. Direct all correspondence concerning Division 26, 27, & 28 submittals to:

Thomas Keeling
PRAIRIE ENGINEERING, P.C.
1905 17TH ST SE
MINOT, ND 58701
tkeeling@prairieengineeringpc.com

C. Shop Drawings

1. Before any of the materials are delivered to the job, submit to Engineer via the Prime Contractor complete Shop Drawings for each item indicated.
2. Include catalog numbers, performance data, dimensions and other descriptive information.
   a. The actual part numbers and options for equipment to be utilized shall be highlighted to indicate exact equipment to be furnished.
   b. Only include information relevant to the equipment being provided. Any extraneous materials shall be removed prior to submittal.
3. Shop Drawings shall be in electronic PDF format and shall include catalog sheets showing all necessary information. Shop drawings shall be separated by specification section, and equipment from separate specification sections shall not be combined.
4. Shop Drawings shall be submitted under the appropriate specification section of the electronic submittal service being used. The shop drawing file for each section shall include the specification section number, section name, and revision number. Example: "262726 Wiring Devices REV 01".
   a. If an electronic submittal service is not being used, shop drawings may be emailed to the Engineer at the email address indicated above. Emailed shop drawings shall not exceed 10 MB. If shop drawings exceed 10 MB, contact the Engineer to arrange for a file transmittal method.
5. Each Shop Drawing folder shall be **stamped, initialed, and dated**, on a cover sheet included in the PDF submittal by Division 26 Contractor to indicate they have thoroughly reviewed them in accordance with General Conditions. **Email message text not acceptable.**
   a. If the Division 26 contractor is under a Prime Contractor, the Prime Contractor may also include a review stamp. However this does not relieve the Division 26 contractor from applying their review stamp.
6. Shop Drawings not in conformance with Specification will be returned to Prime Contractor without review.
7. A maximum of two reviews will be completed for each section. Additional submittals required due to lack of proper corrections being made may be subjected to review fees from the Engineer billed to the Division 26 contractor.

D. As-Built Drawings

1. Designate one set of clean blueprints at project site as As-Built Drawings. Make As-Built Drawings available to Engineer during project visitation.
2. As work progresses, Contractor's field supervisor shall mark As-Built Drawings in red pencil to indicate actual conditions of installation.
3. Show same general details as Drawings.
4. Give particular attention to marking actual locations of feeders and underground runs.
5. Affix all addendum and change order descriptions to appropriate as-built drawing sheet, utilizing spray adhesive.
6. Submit As-Built Drawings to Engineer along with Record Manuals at close of project in PDF format.
   a. As-Built Drawings shall be submitted as one PDF file.
   b. Record Manuals shall be submitted as one PDF file.
7. Provide minimum one hard copy of As-Built Drawings to the Owner.
8. Review Division 1 for additional requirements for hard copies of As-Built Drawings.

E. Record Manuals

1. Upon completion of Work of this Division and as condition of its acceptance, Contractor shall compile Record Manuals.
   a. List project name, date, Contractor's name, address and telephone number on exterior label of each Record Manual.
   b. Provide one electric PDF copy to Engineer for review.
      1) After electronic PDF copy is reviewed and approved, provide one hard copy of Record Manual to Owner. Include an index sheet indicating each major piece of equipment, supplier and supplier's telephone number. Provide tabbed dividers indicating major groupings of equipment.
      2) Review Division 1 for additional requirements for hard copies of Record Manuals.
   c. Record Manual information shall be included for all equipment/material where Shop Drawings are required. **Also include all installation, operation and maintenance data packaged with any equipment**.
2. Turn over to Owner all spare equipment and devices specified and shown. List quantities on contractor letterhead or invoice, obtain signature of Owner's representative acknowledging receipt, and include with each Record Manual.
3. Include one copy of formal instructional recordings, properly identified as to specification section.
4. Include copy of State Electrical Board Wiring Certificate in each Record Manual.
5. Include service equipment fault current calculation and step-down transformer fault current calculations in record manuals. Utility transformer fault current shall be calculated per Section 260553-3.3. Step-down transformer fault current shall be calculated per Section 262200-1.2. Provide in tabular form, as per the following example:

Transformer	kVA	Sec. Voltage	Phase	Impedance	Fault Current	Date Calculated
Utility	300	480	3	1.06%	34,043 amps	11/15/2016
T-1	150	208	3	3.8%	10,958 amps	11/15/2016

6. Calculate the available fault current (AFC) for the mechanical and electrical equipment listed and provide the information in tabular form, utilizing naming convention on the drawings.
   a. HVAC Equipment 1HP and larger
   b. Refrigeration Equipment
   c. Elevator Equipment
   d. Industrial Control Panels
   e. Electrical Distribution Equipment
   f. Branch Panelboards
   g. MCC's.

7. Fault Current Table Format Example:

Equipment	Voltage	Phase	AFC at Equip.	Date Calculated
AH-1	480	3	5,289 amps	11/15/2016
CU-1	208	3	2,321 amps	11/15/2016

8. Transformer fault current table and equipment fault current calculation table shall be grouped together in the same tabbed section of the record manuals.

1.5 QUALITY ASSURANCE

A. Qualifications of Installers

1. For installation and testing, use only trained licensed and experienced workmen familiar with items required and manufacturer's recommended methods.
2. In acceptance or rejection of installed work, no allowance will be made for lack of skill on the part of the workmen.
3. To the maximum extent possible, retain the same supervisory personnel throughout the duration of the Work.

B. Licenses, Permits, Codes and Standards

1. Materials, workmanship and installation: comply with the latest editions of all applicable codes, local ordinances, industry standards, utility company regulations, insurance carrier requirements and these Specifications.
2. Codes and standards shall include, but not necessarily be limited to, the following:
   a. Underwriters Laboratories (UL) or other Nationally Recognized Testing Laboratory (NRTL)
   b. National Electrical Code (NEC)
   c. National Fire Protection Association (NFPA)
   d. Occupational Safety and Health Act (OSHA)
   e. State and local wiring standards
   f. Building and fire codes
3. The more stringent provisions shall govern where provisions of pertinent codes and standards conflict with these Specifications or Drawings. Where Codes, Specifications or Drawings differ with one another, the Contractor will be deemed to have bid the more expensive method. Refer all such discrepancies to the Engineer immediately.
4. Pertinent codes and standards shall not be cited to furnish less than specifically shown or specified.
5. Obtain and pay all permits, inspections, licenses and other charges pertaining to the Work. Upon completion of the Work, furnish proof of acceptance by proper agency having jurisdiction.

1.6 GUARANTEE AND WARRANTY

A. Unless otherwise modified by other sections of this specification, contractor shall guarantee materials, workmanship and the proper operation of equipment for a period of one year. Warranty period shall begin at date of substantial completion, or date of specific equipment commissioning, whichever is later. Contractor shall correct all equipment, material and workmanship found to be defective or non-conforming to the contract documents without cost to Owner.

B. Guarantee shall include trips to the project site by Contractor to adjust electrical equipment as required, ensuring it is operating as intended.

C. Specified guarantee shall not relieve Contractor from liability arising from improper installation or non-compliance with applicable codes.

D. Contractor shall include written warranty statement, indicating start and end dates of warranty period. Warranty statement shall be included with each copy of the Record Manuals.

1.7 CHANGES TO CONTRACT

A. Any required changes to the contract after bid date shall be in accordance with General Conditions/Division 1 and this section. Where any discrepancies between the sections are encountered, the more restrictive section shall apply.

B. Proposed changes shall be accompanied with complete substantiating documentation.

1. Provide an itemized list of quantities for materials, equipment, and supplies.
   a. Include unit costs for each item and extended price.
   b. Include unit labor for each item and extended time.
2. Provide subcontractor proposals that include the same substantiating documentation.
3. Provide quotations from suppliers for any specially ordered equipment.

C. Material costs shall be actual costs to the contractor, obtaining the materials through normal supply channels, including trade and quantity discounts. Utilizing “suggested pricing” from national pricing organizations for unit costs shall not be accepted. Upon request, the contractor or subcontractor shall submit evidence to substantiate the costs.

D. Labor units shall be industry accepted standard labor hours to perform one unit of work. If the work is being performed in a location that is not considered to be standard working conditions for that specific task, additional labor shall be itemized.

E. Labor rates shall be the actual rate paid for the workman category along with associated labor burden. Labor burden shall consist only of the mandatory fringe benefits, labor taxes, and labor insurances as affected by payroll. The owner reserves the right to reject any labor burden which is inconsistent with other similar contractors or where the fringe benefit cost is in excess of established labor agreements.

F. Allowable markups for contractor and subcontractors
1. Overhead on work performed by own forces: 12% maximum.
2. Profit on work performed by own forces: 10% maximum.
3. Commission on work performed by Subcontractors: 5% maximum.
4. Sales tax.
5. Bond and permit increases where applicable.

G. No additional markups shall be allowed for:
1. Field and/or office supervision/administration time.
2. Tool burden.
3. Shop burden.
4. Overhead/Profit applied to work performed by others.

H. Additional costs for travel and subsistence shall only be allowed if the proposal includes a request for extension of the completion date. Furthermore, those costs shall be proportional to the number of working days of the extension.

I. Subcontractors shall compute their costs in the same manner as the contractor. Subcontractors are subject to the same markup constraints as described herein.

J. For changes resulting in credit to the costs, no restocking fees for materials shall be applied by the contractor or subcontractors.

1.8 TEMPORARY FACILITIES

A. Refer to Special Conditions and/or Division 1 for details of temporary facilities.

1.9 APPLICATIONS FOR PAYMENT

A. Refer to Division 1 “Applications for Payment”.

B. Provide one additional copy, sent directly to the Engineer.

C. Format and content:

1. When included with the Bid, the following categories shall be indicated on the application for payment:
   a. *Project mobilization.*
   b. *Demolition*.
   c. *Service & Distribution* (all switchgear, panels, transformers, motor control centers, and loose control/disconnects, installed in place).
   d. *Lighting* (all fixtures and lamps, installed in place, including pre-fabricated wiring system).
   e. *Wiring Devices* (all switches, receptacles, and plates, except voice-data, installed in place).
   f. *Equipment Connections* (HVAC, elevator, food service, etc, connected in place).
   g. *Basic Materials* (all conduit, wire, boxes, supports, fittings, grounding materials, except special systems and voice-data cabling systems, installed in place).
   h. *Fire Alarm & Detection* (all system equipment, installed in place).
   i. *Special Systems* (all system equipment and cabling, installed in place, broken out by Specification Section. Examples include Clock and Program, Intercom, Nurse Call, Public Address, Sound Reinforcement, Rescue Assistance, TV Signal Cabling, Architectural and Theatrical Lighting Controls, and the like).
   j. *Generator* (all system equipment, installed in place).
   k. *Voice-Data Cabling Systems* (all system equipment, installed in place).

PART 2 – PRODUCTS

2.1 MATERIAL

A. Material and equipment shall be as shown or specified. Provide material not specifically described but required for a complete and proper installation of the Work, subject to the acceptance of the Engineer.

B. All material and equipment shall be new when delivered to the job and be listed by a Nationally Recognized Testing Laboratory (NRTL).

C. Owner will not be liable for material installed in non-compliance with codes, standards, and these Contract Documents.

2.2 PRODUCT HANDLING

A. Protection

1. Use all means necessary to protect the materials of this Division before, during and after installation and to protect the installed work and materials of all other trades.

B. Replacements

1. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Engineer and at no additional cost to the Owner.

PART 3 – EXECUTION

3.1 GENERAL

A. Engineer, Architect, or Owner shall not be responsible for the means, methods, techniques, sequences or procedures of construction selected by Contractor.

B. Engineer, Architect, or Owner shall not be responsible for safety precautions and programs incidental to work of Contractor.

C. It is the sole responsibility of Contractor to initiate, maintain, and supervise all safety precautions and programs in connection with the Work.

3.2 SURFACE CONDITIONS

A. Prior to work of each Section of Division 26, 27, & 28, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

B. Verify that work of this Division may be installed in accordance with all pertinent codes, regulations and standards.

3.3 COORDINATION

A. Order material in a timely fashion to assure it is on the job site when required.

B. Coordinate installation of material with schedule of other trades to prevent unnecessary delay in construction schedule.

3.4 DISCREPANCIES, CONSTRUCTION CONFLICTS AND DRAWINGS

A. Discrepancies

1. Prior to submitting bid, Contractor shall refer any apparent discrepancies or omissions to Engineer for clarification.
2. The Architect, Engineer or Owner will not be responsible for any oral instructions or modifications to the contract documents prior to opening of bids.
3. Written interpretation or clarification will be made by Addenda.

B. Construction Conflicts

1. Conflicts discovered during construction shall be immediately called to the attention of the Engineer for decision.
2. Do not proceed with installation in area of question until conflict has been fully resolved.
3. When so directed by Engineer, Contractor shall make minor adjustment to avoid interferences with other trades. Such minor adjustments shall be performed at no additional cost to the Architect, Engineer or Owner.

C. Drawings

1. Drawings indicate extent and general layout of electrical systems for project. Due to small scale, it is not possible to indicate all fittings and accessories that may be required. Provide such fittings and accessories as required to form a complete and operating system in general conformance with Specifications and Drawings.
2. Data indicated on Drawings and in these Specifications is as exact as could be secured, but absolute accuracy is not guaranteed.
3. Exact locations, distances, levels and other conditions will be governed by the structure. Field measurements shall take precedence over the Drawings. Use the Drawings and these Specifications for guidance. Secure the Architect's approval for all changes in locations.
4. Verify all measurements at site. No compensation will be made because of difference between locations shown on the Drawings and measurements at the building.
5. Refer to the architectural drawings for dimensions and locations of walls, partitions, doors, windows, ceiling heights, door swings and other details of construction.

3.5 UNDERGROUND UTILITIES

A. Locations of existing underground utilities are based on available site information and are shown approximately. Contractor shall determine exact utility locations before commencing work and shall be responsible for repair of damages resulting from his construction activities.

B. Trench and backfill for installation of underground conduits to depth shown or required. Remove any accumulated water in excavation by pumping. Shore and brace excavation as required by safety regulations. Provide temporary bridges to maintain normal traffic flow. Excavation and backfill required by electrical installations shall be accomplished in accordance with Earthwork Specifications by this Contractor.

3.6 CUTTING AND PATCHING

A. Carefully lay out all work in advance to minimize cutting, channeling or drilling.

B. Where necessary, all such cutting and patching shall be done in a manner approved by Architect.

C. Restore damaged surfaces to their original condition by skilled mechanics of the trade involved. Contractor at fault shall assume all cost.

D. Use only rotary type drilling tools to cut concrete.

E. Do not endanger the stability of the structure. Do not at any time cut or alter work of any other Contractor without Architect's consent.

3.7 TESTS

A. Perform all tests as required by Engineer during construction and as described in other Sections of these Specifications.

B. Testing of entire installation shall be completed before final inspection.

3.8 INSTRUCTIONS

A. After all required approvals of the Work have been obtained; demonstrate the operation and maintenance of all electrical equipment to the Owner's personnel.

B. Provide written and oral operating and maintenance instructions to Owner's representatives. The oral instructions shall be given before the Owner occupies the buildings. Instructions to include all building's electrical systems and equipment.

C. Copies of written operating and maintenance instructions shall be included with each Record Manual.

D. Electrical Contractor shall coordinate with Owner at Owner's convenience, formal instruction time for contractor personnel to instruct Owner's Representatives on all equipment. Provide similar equipment supplier's instructions where specified thus. Formal instruction to occur with each Record Manual, being referenced to and a part of the Manual.

E. Formal instructions shall be recorded when required by other Sections of this Specification by this Contractor. Format shall be digital media capable of being played on Windows or Mac operating systems, or shall be submitted on a USB storage device.

1. Electronic PDF files for the as-built drawings and record manuals shall also be included on the USB storage device with the formal instructions.

3.9 CLEAN UP

A. Remove all scrap material left on job during and after installation of Work.

B. All equipment having finished paint surfaces shall be examined upon completion for scratches and other damage. Touch up all surfaces as required with paint of color to match factory finish.

C. Perform all cleaning as required by other Sections of Division 26, 27, & 28.

END OF SECTION

SECTION 26 0505 – TEMPORARY FACILITIES & CONTROLS

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Temporary electricity.

1.2 PRODUCT HANDLING

A. Protection

1. Use all means necessary to maintain temporary facilities and controls in proper and safe condition throughout the progress of Work.

B. Replacements

1. In the event of loss or damage, immediately make all repairs and replacements necessary at no additional cost to Owner.

PART 2 – PRODUCTS

2.1 UTILITIES

A. Temporary Facilities

1. General: all costs, including utility company charges, required for the performance of temporary electrical system, shall be paid by Electrical Contractor.
2. Energy charges: Refer to Division 1 for requirements.
3. Temporary Electricity: Electrical Contractor shall:
   a. Furnish and install all necessary temporary wiring.
   b. Provide area distribution boxes located so the individual trades may use their own construction type extension cords.
   c. Provide GFCI protection on all temporary power per NEC.

END OF SECTION

SECTION 26 0519 - CONDUCTORS

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Provide a complete system of conductors enclosed in a raceway.

1.2 SUBMITTALS

A. Record Drawings

1. Maintain accurate record drawings in accordance with Section 260500.

PART 2 – PRODUCTS

2.1 CONDUCTOR

A. Copper

1. Soft drawn, annealed.
2. Conductivity of not less than 98% pure copper.
3. Insulated for 600 volt service.
4. #10 AWG and smaller: Solid, THWN/THHN.
5. #8 AWG and larger: Stranded, THWN/THHN.
6. Provide USE where required by Code.

B. MC Cable

1. MC cable is not acceptable for use as a wiring method.
2.

2.2 VARIABLE FREQUENCY DRIVE (VFD) CABLE

A. Non-armored, Type TC cable with 85 percent tinned copper braid, 100 percent foil shield, and full size copper drain wire.

B. XLPE conductor insulation for 600 volt service.

C. Manufacturer: Belden 29500 series or equivalent.

2.3 SPLICES

A. #10 AWG and smaller: Scotchlock Y, R or G as manufactured by 3M Company, or equivalent.

B. #8 AWG and larger: Compression type, as manufactured by Anderson, Burndy, Thomas and Betts Company, or equivalent.

2.4 LUBRICANT

A. General

1. NRTL-listed.
2. Flame resistant
3. Compatible with conductor insulation.

B. Acceptable Manufacturer

1. As selected by Contractor.

PART 3 – EXECUTION

3.1 INSTALLATION

A. General

1. Install in accordance with Code, product listing, and manufacturer's recommendations.
2. Install wire and cable in Code-conforming raceways after moisture and debris is swabbed from conduit.
3. Refer to system specified for conductor's peculiar to that system.
4. Conductor sizes: Standard AWG, #12 minimum unless otherwise indicated.
5. Fixture taps: minimum #16 AWG.
6. Conductor temperature ratings: Compatible with the equipment to which it is to be connected. Refer to product listing.
7. Make conductor length for parallel feeders identical.
8. Derate ampacities as required for high ambient temperatures or conductor fill.

B. Color

1. Multi-wire (shared neutral) circuits.
   a. 120/208 volt
      1) Phase conductors: Black, red or blue.
      2) Grounded conductor (neutral): White.
      3) Grounding conductor: Green or bare.
2. Separate neutral circuits:
   a. 120/208 volt
      1) Phase conductors: Black, red or blue.
      2) Grounded conductor (neutral): White with stripe colored to match phase.
      3) Grounding conductor: Green or bare
3. Switch legs: Same as phase conductors.
4. 120 volt isolated ground circuits:
   a. Phase conductor: Orange.
   b. Grounded conductor (neutral): White with orange stripe.
   c. Grounding conductor: Green with yellow stripe.

C. Splices

1. Eliminate wherever possible.
2. Made only at outlet or junction boxes.

3. Obtain special permission from Engineer for any splices in feeder conductors.

D. Voltage Drop

1. Increase size of circuit wiring in accordance with NEC 210.19(A)(1), fine print note, No. 4.
2. Use #10 AWG minimum for all home run conductors longer than 75 feet on 120/208/240 systems and 150 feet on 277/480 systems.

E. VFD Cable

1. Install cable from load terminals of VFD to motor.
2. Enclose cable in raceway system (conduit and flexible conduit).
3. Terminate the drain wire to the ground lug at both the VFD and the motor.

3.2 TESTS

A. After equipment and wiring is installed, and before it is energized, test all power circuits with a megohmeter for insulation resistance, phase-to-phase and phase-to-ground faults.

B. Before testing, disconnect all equipment that might be damaged by the test voltages.

END OF SECTION

SECTION 26 0526 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Bond and ground all electrical equipment in accordance with National Electrical Code, State/Local Codes, these Specifications and as shown on Drawings.

B. Description of System

1. The service equipment, conduit systems, supports, cabinets and neutral conductor shall be solidly grounded and bonded in accordance with National Electrical Code to form a permanent effective and continuous grounded system.

PART 2 – PRODUCTS

2.1 GROUND RODS

A. Steel with a metallically bonded outer layer of electrolytically applied copper.

B. Minimum 1/2" diameter 10 foot length, unless otherwise indicated.

C. Sectional rods not permitted.

D. Manufacturer: ERITECH or equivalent.

2.2 GROUND ROD CLAMPS

A. Ground rod clamps shall be high strength silicone bronze.

B. Manufacturer: ERITECH or equivalent.

C. At Contractor's option, exothermic welding (CADWELD) or impact compression (ERITECH Hammerlock) may be used in place of ground rod clamps.

2.3 WATER PIPE GROUND CLAMPS

A. Steel U-bolt with bronze saddle.

B. Thomas and Betts Company 3900 series or equivalent.

2.4 REBAR GROUND CLAMPS

A. Bronze alloy construction.

B. Sized as required by rebar stub out.

C. Eritech RC or EK series as required by local authority. Equivalent products by Thomas and Betts acceptable.

PART 3 – EXECUTION

3.1 GENERAL

A. **Grounding conductors not shown or included on floor plans.**

B. **When required, increase trade size of raceway accordingly.**

C. Aluminum not acceptable for use as a grounding conductor.

3.2 SYSTEM GROUNDING

A. Provide grounding electrode system in accordance with NEC 250.50. If available, each of the items listed in 250.52(A)(1) through (A)(8) shall be bonded together to form grounding electrode system.

B. Connect grounding electrode conductor to grounded service conductor.

C. Provide raceway enclosing grounding electrode conductor. If metallic, bond as per NEC 250.64(E). Provide grounding bushing as required complete with jumpers same size as grounding electrode conductor.

D. To comply with NEC 250.53, provide two ground rods spaced minimum 6'-0" apart.

3.3 EQUIPMENT GROUNDING CONDUCTOR

A. Non-metallic conduit: Sized in accordance with NEC, except as further modified by this Specification.

B. Flexible Metal Conduit, Liquidtight Flexible Conduit.

1. Other than for connection of 120 volt recessed luminaires, not acceptable for use as means of grounding.
2. Provide bonding jumper sized in accordance with NEC around all flexible conduits. Use fittings having lugs for termination of jumper.
3. Spiral wrap not acceptable. Lay along surface, secured with cable ties.
4. Bonding jumper maximum length: 6'.
5. Bonding jumper not required where separate equipment grounding conductor is used.

C. Branch Circuits

1. **Separate equipment grounding conductor required for each raceway.**
2. Size: per NEC 250.122.
3. Bond to grounding bars, junction boxes and luminaire grounding screws.
4. Field install grounding screw in luminaire if not provided by factory.

D. Feeders

1. **Separate grounding conductor required.**
2. Bond to grounding bars in switchboards, panelboards and motor control centers.
3. Provide grounding bushing at both ends of all feeders utilizing metallic raceway.

a. Bond to grounding bars at both ends.
b. Size bonding jumpers to match equipment grounding conductor.

4. Feeder Equipment Grounding Conductor Size:
   a. Size per NEC 250.122.
   b. Copper equivalent ampacity when aluminum phase conductors utilized.
5. Do not splice grounding conductor.

E. Water Pipe System

1. Bond interior metal water piping per NEC Section 250.104(A) if water pipe system is not used as part of grounding electrode system.

END OF SECTION

SECTION 26 0533 - RACEWAYS

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Provide all conduit systems as shown on Drawings or required by Codes and Specifications.

B. Description of System.

1. Provide code-conforming raceway system for all conductors unless specifically noted otherwise by phrase "not in conduit".

1.2 SUBMITTALS

A. Record Drawings

1. Maintain accurate record drawings for all raceway runs in accordance with Section 260500.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Metallic conduit and tubing: Allied Tube and Conduit, Republic Conduit, or equivalent.

B. Non-metallic conduit: Carlon Schedule 40 or Schedule 80 where required, Allied Tube and Conduit, Cantex Inc., or equivalent.

C. Flexible metal conduit: Aluminum.

D. Liquidtight, flexible metal conduit: Anaconda Sealtite or equivalent.

E. Fittings

1. Rigid metal conduit: Appleton, Crouse-Hinds, or equivalent**. Pot metal condulet fittings not acceptable.**
2. EMT:
   a. **Steel.**
   b. Setscrew or watertight as required.
   c. Thomas and Betts Company, or equivalent.
   d. **Pot metal, "Sock-on" and indentor fittings not acceptable.**
3. Flexible metal conduit: STEEL, Thomas and Betts Company XC-400 series, or equivalent.
4. Liquidtight flexible metal conduit:
   a. **Steel.**
   b. Straight or angled as required.
   c. Appleton, Thomas and Betts Company or equivalent.

F. Hangers and Supports

1. As required by Codes and Specifications.
2. Raco, Unistrut, or equivalent.
3. Erico conduit clips, Type 8-M, 12-M and K-8 acceptable for individual branch circuit runs.

G. Metal Surface Raceway

1. Wiremold 500/700 metallic series or equivalent, unless otherwise indicated on Drawings.
2. Provide associated fittings as required.
3. Standard color as selected by the Architect.

H. Wireway

1. NRTL 870 listing throughout, including connectors and fittings.
2. Hinged cover construction.
3. Sealing capability where required.
4. Suitable for "lay-in" installation of conductors.
5. Rust inhibiting phosphatizing undercoat and baked enamel finish.
6. Plated hardware.
7. Square D "Square Duct" or equivalent.

I. Expansion Fittings

1. Metallic: OZ, Thomas and Betts Company, or equivalent.
2. Non-Metallic: Carlon, or equivalent.

J. Firestop Assemblies

1. Firestop systems shall consist of fittings and/or intumescent materials assembled as per UL (or other NRTL) System Details.
2. Product manufacturers: 3M, Chase Technology Corporation, Dow Corning Fire Stop, Hilti, International Protective Coatings Corp. (Flame Safe), Nelson Fire Stop Systems.

K. Thru Wall and Floor Seals

1. OZ-Gedney Type "FSK" or equivalent.

PART 3 – EXECUTION

3.1 INSTALLATION

A. General

1. Electrically continuous throughout.
2. Plumb and level.
3. Cut square and reamed smooth.
4. Use commercial bender for offsets and bends.
5. Cap to prevent debris from entering during construction.
6. Swab conduit prior to installation of conductor.
7. Provide pull cord in empty conduits.
8. Alter conduit routing to avoid structural obstructions, minimizing crossovers.

9. It is the intent of this Specification to provide reasonable provisions for future expansion of electrical use (See NEC 90.8 and 90.1(B), FPN). Therefore, **install all branch circuit home runs as shown on Drawings. Do not combine home runs or increase quantity of conductors therein.**
10. Install raceway, conduit and fittings in accordance with Code, NRTL listing and manufacturer's recommendations.

B. Concealed Interior Raceway

1. Conceal all raceway within building construction.
2. May be run in a direct line for Contractor's convenience.
3. For Contractor's convenience, **concealed** stubs from concrete-encased PVC conduit runs may extend to first **concealed** junction box.
4. Where applicable, center within insulation any electrical conduit routed in attic space. Provide sealing as per NEC 300.7(A) for all conduits exposed to different temperatures.

C. Exposed Interior Raceway

1. Use limited to mechanical and electrical equipment rooms, sheriff shop area, motor connections, and panelboards scheduled as surface.
    a. Run parallel or perpendicular to building lines.
    b. **Provide RGSC or EMT stubs for concrete-encased PVC conduit runs.** Extend stub from RGSC coupling set flush in floor.
    c. Provide flexible conduit as required for motor and equipment connections.
2. Shall not be used in finished areas unless specific permission is obtained from Engineer.
    a. Exposed interior raceway in finished spaces shall be Metal Surface Raceway. Metallic conduit and tubing NOT ALLOWED.
    b. EMT allowed in the shop and garage areas. See keynotes on the plans.

D. Concrete Encased Raceway

1. Shall not interfere with structural integrity of slab, column, or beam.
2. Installation subject to acceptance of Structural Engineer.
3. Maximum diameter 1/3 thickness of concrete member.
4. Install in center of section.
5. Provide expansion fitting when crossing building expansion joint. Grounding integrity of raceway to be maintained.

E. Exterior Raceway

1. Minimum 24" below grade.
2. PVC unless otherwise indicated.
3. **Exterior surface stubs for PVC conduit runs: RGSC, including final underground sweep.** Exterior surface stubs acceptable only where specifically shown.
4. Penetrating Watertight Walls or Floors: Provide block-out with 1/2" clearance around conduit for underground penetrations. Pack with Oakum and caulk with non-shrinking grout, or provide conduit entrance seal.
5. Penetrating Roof or Waterproofing Membranes: Provide flashing and pitch pocket.
6. Contractor responsible for providing a watertight penetration.
7. Coat RGSC penetrations with heavy asphaltic-base compound.
8. Unless otherwise indicated, route exterior conduits to interior distribution equipment concealed under slab.

F. Supports

1. Refer to NEC 300.11
2. **Tie wire supports not acceptable.**
3. Support Spacing: NEC.

G. Specific Locations

1. Allow 6" minimum clearance at flues, steam pipes and heat sources.
2. Conduit visible behind grills and registers: paint black.
3. Seal conduit where leaving heated area and entering unheated area.
4. Penetrating non-watertight walls or floors: Pack space between conduit and block-out on both sides with Oakum.
5. Penetrating fire rated walls or floors: Seal to prevent passage of fire or products of combustion.
6. From each flush mounted panel location, stub three additional 3/4" conduits into nearest accessible ceiling space.
7. Do not mount raceway on ductwork, cover access doors, panels, controls, or otherwise hinder normal maintenance and repair of the equipment.
8. Motors:
   a. Connect to motor feeder or branch circuit by means of flexible metal conduit or liquidtight flexible metal conduit in moist areas.
   b. Minimum flexible length: 18".
   c. Where practical, feed floor mounted motors from raceway installed in or under slab.
   d. When floor mounted motors are fed overhead, provide required support for raceway. Extend raceway to floor and provide a floor flange. Insert "T" condulet fitting at proper height and extend flexible conduit to motor.

H. Specific Systems

1. Life Safety Branch
   a. All raceway systems except those embedded directly in earth or concrete, or surface metal raceway systems (wiremold), shall be externally identified by permanent YELLOW paint suitable for the purpose to easily distinguish from other power raceway systems. Items shall be painted prior to installation. In addition to field painted conduit, factory painted conduit as manufactured by Allied Tube & Conduit or equivalent is acceptable.

2. Critical Branch
   a. All raceway systems except those embedded directly in earth or concrete, or surface metal raceway systems (wiremold), shall be externally identified by permanent ORANGE paint suitable for the purpose to easily distinguish from other power raceway systems. Items shall be painted prior to installation. In addition to field painted conduit, factory painted conduit as manufactured by Allied Tube & Conduit or equivalent is acceptable

3.2 SIZE

A. National Electrical Code, subject to stated minimums.

B. Minimum Size

1. Exterior raceway: 3/4".
2. In or under poured concrete (including precast concrete panels): 3/4".

3. Branch circuit home run: 3/4". Consider home run to include raceway length from panelboard, switchboard, or motor control center to nearest power consuming or switching device on that circuit.
4. Feeders: 3/4".
5. All others not listed: 1/2".

3.3 TYPE

A. Intermediate Metal Conduit (IMC)

1. May be used in place of rigid galvanized steel conduit for Contractor's convenience.
2. Comply with manufacturer's recommendations for bending, threading and cutting operations.
3. Install as specified for rigid galvanized steel conduit.

B. Rigid Galvanized Steel Conduit (RGSC)

1. Use:
   a. Overhead electric and telephone service entrance. IMC or Aluminum not acceptable for this application.
   b. All raceway exposed to weather. Aluminum not acceptable for this application.
   c. Where required by national, state and local codes.
2. Fittings: Threaded except at KO type boxes where double locknut/bushing method acceptable.
3. Waterproof entire length with heavy asphaltic base compound when:
   a. Embedded directly in earth.
   b. Embedded in concrete directly in contact with earth, with or without vapor barrier.
   c. Penetrations run directly from concrete with earth, to soil burial.
4. Factory applied PVC coating acceptable in place of asphaltic base compound.

C. Rigid Non-Metallic Conduit (PVC)

1. Use only in slabs and exterior underground locations. See 3.1 B3, C4 and E3 for limitations.
2. Provide insulating bushing at all terminal adapters.
3. Provide equipment grounding conductor within raceway.
4. Increase trade size accordingly for equipment grounding conductor.
5. Utilize commercial heating element type bending equipment. **Do not use torches to bend PVC conduit.**

D. Electrical Metallic Tubing (EMT)

1. Use in all areas not prohibited by NEC and this Specification.
2. Do not use in concrete slabs on or under grade, or walls under grade.
3. Do not use in exterior underground applications.

E. Flexible Metal Conduit

1. Use for connections to transformers, motors, fixed appliances, recessed luminaires and other equipment as required.
2. Use liquidtight conduit with liquidtight fittings in areas of high moisture content.

F. Metal Surface Raceway

1. Install complete with matching boxes, fittings, and end caps, parallel or perpendicular to building construction.
2. Wire adjacent devices to alternate circuits where metal surface raceway contains devices integral to the channel.
3. Feed from flush connector in wall directly into raceway. Field cut base as required with 1/2" knockout for this purpose. Do not utilize Wiremold catalog #2051H for 2000/2100 series.

G. Fire Resistive Walls and Decks

1. Preserve integrity of fire rating through the use of UL (or other NRTL) Listed firestop assemblies of appropriate penetration type and rating time.
2. Install in accordance with manufacturer's recommendations.
3. All floor to floor penetrations and all wall penetrations into Mechanical, Electrical, and Communications Rooms shall be sealed with 1 hour firestop assemblies unless more stringent rating is required by building codes.
4. Include UL (or other NRTL) firestop assembly sheets and manufacturer product data sheets specifically used with the Project Closeout Documentation.

END OF SECTION

SECTION 26 0534 – OUTLET, PULL AND JUNCTION BOXES

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Provide all outlet, pull and junction boxes complete with associated covers and rings.

B. Work Installed But Furnished Under Other Directives.

1. Obtain manufacturer's backboxes or recommendations for special equipment.

1.2 SUBMITTALS

A. Record Drawings

1. Maintain accurate record drawings in accordance with Section 260500.

PART 2 – PRODUCTS

2.1 CEILING BOXES

A. Flush and Surface

1. 2-1/8" minimum depth.
2. Square or octagon as required.
3. Galvanized steel.
4. Manufacturer: Appleton, Raco, Steel City or equivalent.

2.2 WALL BOXES

A. Flush

1. One and two gang wall boxes: 4" square box, 2-1/8" minimum depth with appropriate plaster or tile ring.
2. More than three gang: Gangable 3-1/2" deep unless wall cavity limits depth to 2-1/2".
3. Use 4-11/16" square boxes where required by Code.
4. Single gang masonry boxes acceptable only for single conduit entrance. Feed-through circuiting not acceptable. Use 4" square box/tile ring for feed-through applications.

B. Surface Mounted Devices

1. 4" square box, 2-1/8" minimum depth with appropriate 1/2" raised cover.
2. Manufacturer: Appleton, B-Line, Raco, Steel City, Wiegmann, or equivalent.

C. **Sectional, through wall and handy boxes not acceptable.**

2.3 PULL AND JUNCTION BOXES

A. Galvanized steel with cover.

B. Size: National Electrical Code.

C. Manufacturer: Appleton, Raco, Hoffman, Shallbetter, Steel City, Wadsworth or equivalent.

PART 3 – EXECUTION

3.1 INSTALLATION

A. General

1. Install in accordance with code, product listing and manufacturer's recommendations.
2. Install boxes plumb, level and flush with finish surface.
3. Support securely and rigidly.
4. Verify wall depths to ensure adequate clearance for special backboxes.
5. Provide barriers in ganged switch outlets where voltage between adjacent switches exceeds 300 volts.

B. Location

1. Governed by structural conditions and obstructions.
2. Mount switch outlet on strike side of door, maximum 4" from door opening to first switch. Verify door swing with Architectural Plan.
3. Coordinate equipment outlets prior to installation for proper concealment.
4. Center outlets with respect to acoustical tile, paneling and furring trim.
5. Adjust outlets in masonry or tile construction to horizontal and vertical mortar joints.
6. Clear all piping, ductwork and other obstructions.
7. For outlet boxes on opposite sides of walls or partitions with separation distances of 24" or less, pack all interconnecting conduits with Duxseal after conductor installation, to prevent sound transmission.
8. Outlet boxes improperly located shall be corrected at Contractor's expense.

C. Mounting Heights

1. All device mounting heights shall conform to ADA Recommendations. Refer to Standard Electrical Symbol Legend for nominal mounting heights.
2. Verify height of all outlets to ensure installation above top of radiation covers, mirrors, counters and any other obstructions that may alter nominal mounting height.
3. **Measure from finish floor to centerline of outlet.**
4. Mount exterior outlets horizontally. Measure height from nearest interior finish floor below outlet.
5. Mount outlet designated AC (above counter) no less than 4" higher than top of countertop backsplash.

D. Fire Resistive Walls and Ceilings

1. Penetrations for steel electrical outlet boxes permitted, provided:
   a. Boxes do not exceed 16 square inches in area.

b. Area of such openings shall not exceed 100 square inches for any 100 square feet of area.
c. Outlet boxes on opposite sides of walls or partitions separated by horizontal distance of 24 inches.

E. Pull and Junction Boxes

1. Pull and junction boxes are generally not indicated on Drawings.
2. Install in accordance with National Electrical Code and as required to facilitate wire pulling.
3. Do not install in finished spaces without approval of Engineer.

F. Identification

1. Identify pull and junction boxes containing system voltages in excess of 250 volts to ground with voltage markers.
2. Voltage markers: Not visible in finished areas.

END OF SECTION

SECTION 26 0536 – CABLE TRAY

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Provide cable tray systems as shown on Drawings.

B. Description of System.

1. Provide complete cable tray system shown on Drawings and herein specified. System shall be of one manufacturer with all drop-outs, supports, and all other hardware required for a complete, acceptable, and approved system.

1.2 SUBMITTALS

A. Shop Drawings

1. Submit information in accordance with Section 260500.
2. Indicate:
   a. Product dimensions
   b. Mounting details
   c. Support hardware

PART 2 – PRODUCTS

2.1 MANUFACTURER

A. Sizing and design based upon B-Line equipment. B-Line catalog numbers used for reference.

B. Other acceptable manufacturers: Cablofil, Snake Tray, Mono-Systems, Inc., WBT, or equivalent.

2.2 BASKET TYPE TRAY

A. ASTM A510 Grade 1008 steel construction with mesh size no larger than 2” x 4”.

B. All welds and edges smoothed free of burrs and sharp edges.

C. Zinc plated after fabrication.

D. 4 inch load depth and 8 inch width.

E. Include black plastic insert wherever cable tray is visible from the floor (not concealed above ceilings).

F. Manufacturer: B-Line FT Series.

2.3 CABLE RUNWAY

A. Made from 1-1/2” x 3/8”, 16 gauge tubular steel.

B. Welded cross members at a maximum of 9 inch intervals.

C. Painted or plated finish.

D. Nominal 10’ section length.

E. Nominal 9 inch width.

F. Manufacturer: Snake Tray #CM-610 Series, Hoffman #LSSXXBLK Series, Middle Atlantic #CLB-10 Series, Cooper B-Line #SB17UXXB Series.

2.4 MISCELLANEOUS PRODUCTS

A. Firestop Assemblies

1. NRTL listed 4” square pathway with intumescent material designed to seal out fire, smoke, and toxic gases.
2. Quantity shall equal or exceed the width of the associated cable tray. i.e. a 6” wide tray requires two pathways.
3. Include mounting accessories as required by application specifics.
4. Manufacturer: EZ Path Series 44, 3M Model PT4SD or approved equal.

B. Equipment Grounding Conductors

1. Required when specified for power circuits.
2. Bond in accordance with NEC 250.96 and 250.102.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install in accordance with NEC and manufacturer’s instructions.

B. Install Basket Type Tray where indicated in all areas except Network Rooms.

C. Install Cable Runway wall to wall in Network Rooms above data racks for cable distribution and lateral rack support.

D. Coordinate installation to avoid conflicts with light fixtures, duct work, piping, or other mechanical equipment.

1. Tray does not have to be completely continuous. Section breaks of up to 36” are allowable for ductwork and other mechanical equipment conflicts.

E. Provide backing for wall-mount track and support for ceiling-mount tray as required.

F. No exposed hanger rod threads from bracket to a minimum of 6” above top of tray.

G. Fire Resistive Walls.

1. End cable tray within 6” of each side fire rated walls.
2. Install Firestop Assembly through rated wall as per manufacturer’s recommendations.

H. All floor to floor penetrations and all wall penetrations into Mechanical, Electrical, and Communications Rooms.

1. End cable tray within 6” of each side of penetration.
2. Install Firestop Assembly through floor or wall as per manufacturer’s recommendations.

END OF SECTION

SECTION 26 0540 – FLOOR BOXES

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Provide floor boxes complete with devices, fittings and carpet flanges.

1.2 SUBMITTALS

A. Shop Drawings

1. Submit information in accordance with Section 260500.
2. Show all details, including dimensions and service fitting repair parts.

B. Record Manuals

1. Submit information in accordance with Section 260500.
2. Include installation and maintenance instructions accompanying equipment.

PART 2 – PRODUCTS

2.1 CONCRETE FLOOR SLABS

A. Type A

1. Box
   a. Listed and evaluated by an NRTL to meet the applicable U.S. safety standards for scrub water exclusion when used on tile, terrazzo, wood, and carpet covered floors.
   b. Classified for use in 1, 1 1/2, and 2 hour fire rated floor systems.
   c. 8” round with five compartments.
   d. Construction:
      1) Stamped steel with integral intumescent firestop material.
      2) Insertion tabs to hold body in place without additional fasteners.
      3) Enamel finished interior.
   e. Device Plates and Accessories:
      1) One #68REC two 20 amp duplex prewired receptacles.
      2) One #8ACT8A communications mounting plate.
      3) One #8TRAC communications mounting plate.
      4) One #8SER communications mounting plate.
      5) One #8DEC decorator style mounting plate with four data jacks.
         a) If Panduit Mini-Com Modules are being supplied, provide Panduit #CFG series 4-module frame.
      6) One #575CHA bottom housing assembly.
      7) One #5BLH bottom housing assembly.
      8) Three #1PTHA bottom housing assembly.
      9) One #175CHA-LJB bottom housing assembly.
      10) One #22CHA bottom housing assembly.

11) One #1100CHA bottom housing assembly.
12) One #8DIV 8" Divider.

f. Die cast aluminum, round activation cover.
1) Surface mount flange to accommodate carpet floor finish.
2) Finish as selected by the Architect.
a) Powder coat finish: Black, Bronze, or Gray.
b) Metallic finish: Brushed Aluminum, Satin Brass, or Satin Nickel.

g. Manufacturer: Wiremold Evolution series.

B. Type B

1. Box
a. Listed and evaluated by an NRTL to meet the applicable U.S. safety standards for scrub water exclusion when used on tile, terrazzo, wood, and carpet covered floors.
b. Classified for use in 1, 1 1/2, and 2 hour fire rated floor systems.
c. 8" round with five compartments.
d. Construction:
1) Stamped steel with integral intumescent firestop material.
2) Insertion tabs to hold body in place without additional fasteners.
3) Enamel finished interior.
e. Device Plates and Accessories:
1) One #68REC two 20 amp duplex prewired receptacles.
2) One #8ACT8A communications mounting plate.
3) One #8TRAC communications mounting plate.
4) One #8SER communications mounting plate.
5) One #8DEC decorator style mounting plate with four data jacks.
a) If Panduit Mini-Com Modules are being supplied, provide Panduit #CFG series 4-module frame.
6) One #575CHA bottom housing assembly.
7) One #5BLH bottom housing assembly.
8) Three #1PTHA bottom housing assembly.
9) One #175CHA-LJB bottom housing assembly.
10) One #22CHA bottom housing assembly.
11) One #1100CHA bottom housing assembly.
12) One #8DIV 8" Divider.
f. Die cast aluminum, round activation cover.
1) Surface mount flange to accommodate carpet floor finish.
2) Finish as selected by the Architect.
a) Powder coat finish: Black, Bronze, or Gray.
b) Metallic finish: Brushed Aluminum, Satin Brass, or Satin Nickel.
g. Manufacturer: Wiremold Evolution series.

C. Type C

1. Box
a. Listed and evaluated by an NRTL to meet the applicable U.S. safety standards for scrub water exclusion when used on tile, terrazzo, wood, and carpet covered floors.
b. Classified for use in 1, 1 1/2, and 2 hour fire rated floor systems.
c. 8" round with five compartments.
d. Construction:
1) Stamped steel with integral intumescent firestop material.
2) Insertion tabs to hold body in place without additional fasteners.

3) Enamel finished interior.

e. Device Plates and Accessories:
   1) Two #68REC two 20 amp duplex prewired receptacles.
   2) One #8DEC decorator style mounting plate with four data jacks.
      a) If Panduit Mini-Com Modules are being supplied, provide Panduit #CFG series 4-module frame.
   3) One #575CHA bottom housing assembly.
   4) One #5BLH bottom housing assembly.
   5) Three #1PTHA bottom housing assembly.
   6) One #175CHA-LJB bottom housing assembly.
   7) One #22CHA bottom housing assembly.
   8) One #1100CHA bottom housing assembly.
   9) One #8DIV 8" Divider.

f. Die cast aluminum, round activation cover.
   1) Surface mount flange to accommodate carpet floor finish.
   2) Finish as selected by the Architect.
      a) Powder coat finish: Black, Bronze, or Gray.
      b) Metallic finish: Brushed Aluminum, Satin Brass, or Satin Nickel.

g. Manufacturer: Wiremold Evolution series.

D. Type D

1. Box

a. Listed and evaluated by an NRTL to meet the applicable U.S. safety standards for scrub water exclusion when used on tile, terrazzo, wood, and carpet covered floors.
b. Classified for use in 1, 1 1/2, and 2 hour fire rated floor systems.
c. 6" round with three compartments.
d. Construction:
   1) Stamped steel with integral intumescent firestop material.
   2) Insertion tabs to hold body in place without additional fasteners.
   3) Enamel finished interior.
e. Device Plates and Accessories:
   1) One #68REC two 20 amp duplex prewired receptacles.
   2) One #8DEC decorator style mounting plate with four data jacks.
      a) If Panduit Mini-Com Modules are being supplied, provide Panduit #CFG series 4-module frame.
   3) One #575CHA bottom housing assembly.
   4) One #5BLH bottom housing assembly.
   5) Three #1PTHA bottom housing assembly.
   6) One #175CHA-LJB bottom housing assembly.
   7) One #22CHA bottom housing assembly.
   8) One #1100CHA bottom housing assembly.
   9) One #8DIV 8" Divider.
f. Die cast aluminum, round activation cover.
   1) Surface mount flange to accommodate carpet floor finish.
   2) Finish as selected by the Architect.
      a) Powder coat finish: Black, Bronze, or Gray.
      b) Metallic finish: Brushed Aluminum, Satin Brass, or Satin Nickel.
g. Manufacturer: Wiremold Evolution series.

2.2 DEVICE QUANTITIES

A. Type A: Two duplex receptacles, two data jacks, one XI input, one mic input.

B. Type B: Two duplex receptacle, two data jacks, one HDMI input, and one decora plate for future. See Detail 1/E404 or 2/E404.

C. Type C: Either four duplex receptacles and four data jacks, or one powered furniture feed and associated network feed as per the final furniture selected. Verify with furniture vendor prior to installation.

D. Type D: Two duplex receptacles, four data jacks.

2.3 WIRING DEVICES

A. Power: Receptacles as per Section 262726.

B. Voice/data: Jacks as per Section 271500.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Verify concrete depth prior to ordering floor boxes.

B. Verify exact location of each floor box with Architect prior to installation.

C. Install box opening flush with floor in accordance with Code, product listing and manufacturer's recommendations.

D. Activation Cover Installation

1. Carpet/VCT floor finishes: Install cover after floor covering installation is completed.
2. Tile floor finishes: Install cover prior to tile/grout installation. Shim cover as required so top of cover is flush with floor.

E. Install floor boxes with square covers parallel or perpendicular to building lines.

END OF SECTION

SECTION 26 0553 - IDENTIFICATION

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Label electrical equipment as required by Codes and Specifications and as specifically directed by Engineer.

PART 2 – PRODUCTS

2.1 PANEL DIRECTORIES

A. Include directory cards with panelboards.

2.2 NAMEPLATES

A. Machine engraved black laminate with white core, except as otherwise indicated.

B. Minimum letter size: 1/8".

C. Minimum plate size: 1" X 3".

2.3 VOLTAGE MARKERS

A. Vinyl impregnated cloth markers with legend as required.

B. Manufacturer: Ideal #44-360, or equivalent.

2.4 PRESSURE SENSITIVE TAPE

A. Use only when specifically referred to in other Sections.

B. Manufacturer: Dymo, or equivalent.

2.5 UNGROUNDED CONDUCTOR IDENTIFICATION

A. As per NEC 210.5(C) and 215.12(C).

B. Typewritten cards behind plastic shield, affixed with double-stick carpet tape. Heat surface prior to affixing directory.

PART 3 – EXECUTION

3.1 GENERAL

A. Directory Cards

1. **Typewritten only.** Hand lettering unacceptable, except at "spares" and "spaces", where neat hand lettering with erasable pencil is required.
2. Indicate type of load and rooms where load occurs.
3. **Do not use room numbers as shown on Drawings, but refer to name and numbers on door.**
4. Do not identify until final load balancing is accomplished.

B. Nameplates

1. Apply plumb and level with two counter-sunk screws.
2. Glue, double-stick tape, or similar adhesive not acceptable.

C. Device Plates

1. Machine engrave directly on plate in lieu of separate nameplate.
2. Fill inscriptions with contrasting color.

D. Voltage Markers

1. Not visible in finished areas.

E. Junction Boxes

1. Mark all covers with indelible marker to indicate panelboard designation and circuit numbers for circuits contained within box.

3.2 EMERGENCY SYSTEM COMPONENTS

A. All boxes and enclosures (including transfer switches, generators and power panels) for emergency circuits shall be permanently marked so they will be identified as a component of an emergency circuit for system.

3.3 SERVICE EQUIPMENT FAULT CURRENT NAMEPLATE

A. Provide warning nameplate on each service disconnecting means enclosure indicating the fault current of the system.

B. Fault current shall be calculated at the utility transformer, using an assumed infinite primary bus, and using the actual transformer impedance and kVa values.

C. Red laminate with white core.

D. Letter height: minimum ¼”

E. Legend

SERVICE AVAILABLE FAULT CURRENT: _____
TRANSFORMER KVA: _____
TRANSFORMER IMPEDANCE: _____
DATE: _____

END OF SECTION

SECTION 26 0573 – POWER SYSTEM STUDY

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Provide a complete fault current analysis and protective device coordination study in accordance with IEEE 242 for the entire distribution system utilizing computer based modeling. If the project interfaces with existing electrical equipment, utilize the first existing upstream overcurrent device outside the project scope as a fixed reference point.

2. Provide a complete arc flash analysis in accordance with IEEE 1584 requirements. Install specific Arc Flash Protection Boundary and Personal Protective Equipment level label on all electrical equipment within the study scope in accordance with NFPA 70E.

1.2 QUALIFICATIONS

A. The analysis and report shall be performed by a professional engineer licensed in the state where the Project is located. The engineer shall be regularly engaged in the practice of short circuit, device coordination, and arc flash studies utilizing computer programs.

1.3 SUBMITTALS

A. Shop Drawings:

1. Preliminary Fault Current and Coordination reports shall be submitted and approved as a prerequisite to approval of associated electrical distribution equipment shop drawings. The system model shall include:
   a. Utility Transformer and Metering Equipment
   b. Power Distribution Equipment
   c. Motor Control Centers
   d. Branch Panelboards
   e. Transformers
   f. Generators and Transfer Equipment
   g. UPS systems
   h. Elevators
   i. HVAC Equipment 10 HP/30 MCA and larger
   j. Refrigeration Equipment
   k. Industrial Control Panels

2. Submit information in accordance with Section 260500. Show all details of:
   a. General report information including labeling convention and computer program utilized.
   b. Single-line diagram.
   c. Equipment input data.
   d. System impedance diagram utilizing estimated feeder lengths based on anticipated conduit routing.
   e. Fault current and equipment duty evaluation reports.
   f. Preliminary device setting reports including time current curves.

g. Evaluation results and recommendations if any.
h. Sample Arc Flash Label.

3. Final Fault Current and Coordination reports shall be submitted after all final conductor lengths are known. Any settings adjusted based on any changes during construction shall be indicated on final report. Any changes to the drawings during construction that impact the fault current and coordination report shall also be included in the final report.

B. Record Manuals

1. Submit information in accordance with Section 260500.
2. Include final fault current and coordination report, with all corrections and changes included.
3. Include Arc Flash Hazard Report.

PART 2 – PRODUCTS

2.1 COMPUTER SOFTWARE DEVELOPERS

A. The computer program utilized for the analysis shall be nationally distributed and in wide use. Software algorithms shall comply with requirements of standards referenced in this specification and reports shall comply with IEEE 399.

B. Acceptable Manufacturers.

1. CGI CYME
2. EDSA Micro Corporation.
3. ESA Inc.
4. Operation Technology Inc.
5. SKM Systems Analysis, Inc.

PART 3 – EXECUTION

3.1 POWER SYSTEM DATA

A. Single-line diagram.

1. Include the product specific data for all components considered in the study. Equipment labeling tags shall be consistent with the electrical distribution system diagrams shown on the Drawings.
2. Equipment types, model, and ratings shall be displayed. Transformers and generators shall include kVA, impedance data, and voltage information. Motors shall include horsepower. Feeders shall display conductor size and length.

B. Impedance diagram shall indicate resistance and reactance of feeders.

3.2 FAULT CURRENT STUDY

A. Maximum Momentary (1/2 cycle) and Interrupt (5 cycle) rms symmetrical fault currents shall be calculated for both three-phase bolted fault and phase to ground fault conditions. Separate calculations shall be performed for normal power sources and alternate power sources if they exist.

B. Utilize single-line diagrams to display fault currents for different conditions and scenarios.

C. Equipment Duty Report shall verify interrupt ratings of overcurrent protective devices comply with associated ANSI/IEEE standards.

1. The tabulation type report shall indicate the overall maximum available fault current at each device and the device's short-circuit withstand rating.
2. The report shall highlight any devices with areas of concern and/or inadequacies. These issues shall be promptly brought to the Engineer's attention.

3.3 COORDINATION STUDY

A. The protective device study shall be developed to provide selective coordination of overcurrent protection devices in areas of the distribution system required by the NEC. All other areas of the distribution system shall be coordinated to the greatest extent possible so as to minimize (localize) outages during fault clearing.

1. If any aspects of the system coordination are found to be unacceptable by either the Coordination Study Engineer or the Project Engineer, the Equipment supplier shall be responsible for costs associated with any required circuit breaker frame or trip module changes.

B. Device settings shall fully protect feeders and equipment in accordance with associated IEEE standards. Settings shall not result in nuisance tripping of devices due to inrush or magnetization of equipment.

C. In order to minimize arc flash hazard, pick up and time delay settings of each device shall be set as low as possible without compromising system coordination, damage protection, and nuisance tripping.

D. Log type time/current curves shall be submitted that graphically illustrate the coordination of devices installed in series of a circuit. Provide separate sets of curves for alternate power source scenarios. Each Coordination Curve shall show the following information:

1. Device labels
2. Time/current curves of each overcurrent protection device, cut off at maximum fault-current point.
   a. Sensor settings shall be displayed with the device label.
3. Transformer damage curves and inrush points.
4. Feeder damage curves.
5. Motor starting curves.

E. A tabulation type summary of selected settings for all overcurrent protection devices shall be included in the submittal.

F. Where selectivity cannot be achieved, the Engineer of Record shall be promptly notified of the cause and any recommendations available.

3.4 ARC FLASH STUDY

A. Upon approval of all overcurrent protection device settings, provide arc flash calculations in accordance with IEEE 1584-2018 method to determine the Arc Flash Boundary and Personal Protective Equipment (PPE) level for all equipment included in the study.

B. The calculations for each piece of equipment shall be based on the upstream trip device. Do not incorporate the fault clearing properties of any “Main Overcurrent Device” that is integral with the equipment.

C. Provide a tabulation type report that includes estimated arc fault ampacity and time, incident energy, flash boundary, and required PPE.

3.5 INSTALLATION

A. Test, calibrate, and adjust the overcurrent protective devices as recommended in the Coordination Study.

1. Furnish letter of verification that all overcurrent protective device settings have been properly adjusted. Verification shall be performed by the power study engineer, a representative of the power study engineer, or the engineer of record. List date of inspection, name of inspector, and names of any other persons in attendance.

B. Install ANSI type Arc Flash Labels in accordance with NFPA 70E that include Boundary and PPE information on all associated electrical equipment.

END OF SECTION

SECTION 26 0583 – CONNECTIONS TO EQUIPMENT

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. The Contractor shall provide operational electrical connections to all electrically driven or controlled equipment.

PART 2 – PRODUCTS

2.1 MATERIALS

A. General

1. The Contractor shall provide all necessary materials and labor required to make final operational connections to all equipment, generally as shown on the Drawings, and specifically as required by equipment specifications and installation literature.
2. Control devices and panels furnished by others will be delivered to the contractor at the jobsite, and shall be installed in accordance with manufacturer's printed instructions. Review equipment specifications to determine extent of work involved.

PART 3 – EXECUTION

3.1 GENERAL

A. Provide operational connections for all equipment shown on the Drawings. Connections shall be in accordance with manufacturer's recommendations, and shall be left operating in a manner acceptable to the Engineer and Owner.

B. Provide available fault current calculations for equipment listed in Section 260500-1.4E based on actual installation criteria (conductor lengths, raceway types, etc.). Calculations shall incorporate the current limiting effects of fuses supplied with local disconnecting means. Include calculation information in Record Manuals.

C. For all exterior mechanical equipment, provide weatherproof GFCI receptacle outlet within 25' of equipment, circuited to nearest unswitched power. Refer to NEC 210.63 and 406.8.

D. For all mechanical equipment located in attic and crawl spaces, provide porcelain lamp holder with integral receptacle and lamp guard, circuited to nearest unswitched power via pilot handle toggle switch near access hatch. Engrave plate. Refer to NEC 210.70(C).

3.2 CLEANING

A. **Clean** and **vacuum interior** to remove all wire and insulation scraps, dust and dirt.

B. Clean all exposed surfaces immediately prior to final inspection.

END OF SECTION

SECTION 26 0943 – NETWORK LIGHTING CONTROL SYSTEM

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. It is the intent of this Specification to provide all necessary equipment as detailed, for a complete lighting control system.
2. The work included under this Specification shall cover:
   a. All labor, materials and equipment to furnish the lighting control system herein specified.
3. The work shall include the services of a commissioning agent. The commission agent shall be a factory-trained representative who shall commission the system for proper operation and instruct the Owner as to proper operation, programming, and maintenance.

1.2 SUBMITTALS

A. Shop Drawings

1. Submit information in accordance with Section 260500.
2. Submit floor plan drawing indicating all device locations and circuitry requirements between devices.
3. Provide connection/riser diagram for specific project involved. Upon Engineer's review, provide **additional three** copies for Contractor use at the project site and for Record Drawing/Manual submittal at project closeout.

B. Manuals

1. Provide information in accordance with Section 260500. Manuals shall include descriptions of equipment and methods of maintenance and operations.

PART 2 – PRODUCTS

2.1 CONTROL SYSTEM COMPONENTS

A. Component communication shall be by low voltage hard wired protocol and/or by a wireless mesh network.

B. Switches, modules, and sensors shall be as indicated on the drawings.

1. Unless otherwise indicated on the Drawings, wall switches for wireless control systems shall be powered by line voltage. Battery powered devices not acceptable.
2. Battery powered wireless daylight sensors shall be acceptable.
3. Switching relays that are utilized for emergency egress lighting shall be in conformance with UL 924.

2.2 NETWORK INTERFACE

A. Provide all hardware to create a fully connected lighting control system that allows for end user access to the connected (wired/wireless) lighting system devices via LAN.

1. Lighting control devices and equipment included in the network shall be as indicated on the Drawings. They shall include, but not be limited to public areas, corridors, stairwells, private spaces, and exterior building/site.

2. Where the system includes wireless devices, include adapter/area modules as required to interface wireless devices with the network. Manufacturer responsible for quantity of modules to ensure coverage of wireless devices.

3. Manufacturer: Cooper WaveLinx CORE system, Lithonia nLight ECLYPSE system, or approved equal.

B. Connected System Interface.

1. Interface shall be accessible via free operational software package and/or onboard web GUI. Connections shall utilize HTTPS (industry-standard certificate based encryption).
2. Interface shall allow for daily, weekly, monthly, and calendar scheduling of events via time-of-day, photocontrol, and astronomical clocks.
3. The system shall allow users to monitor, control, and make adjustments to all connected devices. It shall provide real time energy usage data.
4. The system shall supervise all connected devices, and provide real time alarms for System faults. Alarms shall include context-sensitive troubleshooting tips.
5. The system shall include a gateway to integrate with BACnet protocol building automation systems.
    a. BACnet integrator shall be able to monitor, adjust, and control all devices similar to lighting network.
    b. BACnet integrator shall be able to obtain lighting system energy usage data.

2.3 SEQUENCE OF OPERATIONS

A. The following descriptions are intended to provide a baseline operational platform for the system. All specific operating points shall be verified with the end user. If not acceptable to the end user, alternative points shall be offered and approved by the Engineer.

1. Training Room and Garage:
    a. Individual zone raise/lower as indicated on drawings
    b. Occupancy Sensors shall operate in Vacancy Mode (switch on, auto off) after 20 minutes.
    c. Daylight Harvesting override for all luminaires along the exterior row.
2. Individual Office:
    a. Occupancy Sensors shall operate in Occupancy Mode (auto on, auto off) after 30 minutes.
3. Corridors
    a. Schedule as directly by owner.
    b. Wall switches deactivated during scheduled “on” time.
    c. Off sweep every 2 hours of scheduled “off” time.
4. Parking Lot
    a. Dusk-to-Dawn operation.
    b. Maintain 100% until 11:00 pm.
    c. Occupancy Mode Dim to 20% after 11:00 pm.

PART 3 – EXECUTION

3.1 STORAGE

A. Store Lighting Control Components in a cool, dry space prior to installation.

3.2 INSTALLATION

A. General

1. Install where shown on Drawings, plumb and level.
2. Top of trim 6’-3” above finished floor for wall-mounted panel.
3. Conductors neatly dressed and banded with nylon cable ties.
4. From each flush installation, stub three additional 3/4” conduits into nearest accessible ceiling space to provide for future utilization of spare circuits.
5. Provide 3/4” plywood backing for all surface-mounted panels.
6. Provide individual terminal or lug for each wire. Multiple wires to common terminal or several terminals for single stranded conductor not acceptable.

B. Provide low voltage cabling from control panel to peripheral devices as per manufacturer’s instructions. Provide raceway system where concealed in walls, in mechanical rooms, and rooms without accessible ceilings. Cable shall be plenum-rated where installed above accessible ceilings and not in raceway.

C. Provide engraved identification nameplate for system cabinet as per Specification 260553.

D. Provide control station identification as per Drawings.

3.3 TESTS

A. Upon completion of the installation, the system shall be commissioned by the manufacturer’s factory authorized representative. The commissioning agent shall configure the system as per the sequence of operation, make any adjustments/additions to the configuration as required or instructed, and verify the complete operation of the entire system.

1. Electrical contractor shall notify owner and engineer twenty one (21) working days in advance to scheduling system commissioning.

B. Furnish a letter of verification to Engineer indicating that the system has been tested and configured by manufacturer’s representative and is found to be complete and functional. List date of test and name of manufacturer’s representative. Testing to include a functional test of all devices and verification of proper configuration for all devices. Notify Owner and Engineer one week in advance of scheduled tests.

C. As part of the required project close out Record Manuals, provide documentation on the commissioning of the system including room by room description indicating:

1. Sensor parameters, time delays, sensitivities and daylighting setpoints.
2. Sequence of operation, (e.g. manual ON, Auto OFF. etc).
3. Load parameters (e.g. blink warning, etc).

3.4 INSTRUCTIONS

A. After system commissioning is complete, the commissioning agent shall provide the Owner with complete instructions as to proper operation and maintenance of the lighting control system.

B. Record instructions and include with manual in accordance with Section 260500.

3.5 CLEANING

A. **Clean** and **vacuum interior** to remove all wire and insulation scraps, dust and dirt.

B. Clean all exposed surfaces immediately prior to final inspection.

END OF SECTION

SECTION 26 2200 - TRANSFORMERS

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Provide power transformers for voltage transformation where shown on Drawings.

1.2 SUBMITTALS

A. Shop Drawings

1. Submit information in accordance with Section 260500.
2. Include:
   a. Primary and secondary voltage.
   b. KVA rating.
   c. Impedance.
   d. Wiring diagram.
   e. Quantity and percentage taps.
   f. Dimensions.
   g. Weight.
   h. Any other pertinent information.

B. Record Manuals

1. Submit information in accordance with Section 260500.
2. Include:
   a. Shop Drawing submittal.
   b. Installation and maintenance instructions furnished with transformer by manufacturer.
   c. Provide available secondary terminal fault current calculation based on actual transformer impedance. In lieu of infinite primary buss, utilize actual available primary fault current in the calculation.

1.3 QUALITY ASSURANCE

A. Codes and Standards

1. Construct and rate all transformers in accordance with UL Standard 506, National Electrical Codes, American National Standard Institute Specification C57.12 and National Electrical Manufacturers Association Specification ST-20.
2. Transformer losses and efficiencies shall be in compliance with the U.S. Department of Energy's requirements.

PART 2 – PRODUCTS

2.1 TRANSFORMERS

A. Rating

1. Dry type, three phase 480 Delta primary and 120/208 Wye secondary.
2. KVA rating: Scheduled on Drawings.

B. Cores

1. High grade, non-aging silicon steel.
2. Maximum magnetic flux densities substantially below saturation level.
3. Core laminations clamped and compressed to provide quite operation.
4. Core and coil assembly bolted to enclosure base, but isolated by means of rubber, vibration-absorbing mounts.
5. No metal-to-metal contact between core and coil assembly and enclosures.
6. Sound isolating systems requiring complete removal of all fastening devices not acceptable.
7. Core electrically grounded to enclosure by means of flexible copper grounding strap.

C. Sound Levels

1. Quiet type with design level which operates at/or below published NEMA standards.

KVA	NEMA Standard Sound Level
0-9	40
10-50	45
51-150	50
151-300	55
301-500	60

D. Coils

1. Aluminum conductors.
2. Continuous wire wound construction.
3. Impregnated with thermo-setting varnish.
4. Final wrap of electrical insulating material to prevent mechanical injury to coil.

E. Primary taps

1. Ratings less than 15 KVA: Two 5% FCBN taps.
2. Ratings 15 KVA and larger: Two 2-1/2% FCAN and four 2-1/2% FCBN taps.

F. Insulation Systems

1. Class 220°C insulation, 115°C temperature rise.
2. 115°C temperature rise not to be obtained by use of forced air cooling or by over-ventilating coil.

G. Enclosures

1. Sheet metal, degreased, phosphatized and finished with baked outdoor enamel.
2. VENT GUARD/RODENT GUARD REQUIRED ON ALL EXTERIOR LOCATIONS.

H. Wiring Compartments

1. Adequately sized for compliance with NEC.
2. Listed for 75° C wire.
3. Locate at bottom of transformer.
4. Rigidly mounted terminals to accommodate wiring lugs.
5. Enclosure temperature rise not to exceed 35°C rise above a 40°C ambient.
6. Rating 10 KVA and less: Non-ventilating enclosure.
7. Rated above 10 KVA: Ventilated enclosure with openings designed to prevent accidental access to energized parts.
8. Weatherproofed for exterior locations.

I. Manufacturer

1. All transformers shall be supplied by the same manufacturer.

2. Manufacturer's nameplate to include:
   a. Manufacturer's name.
   b. Primary and secondary voltages.
   c. KVA rating.
   d. Serial number.
   e. Catalog number.
   f. Impedance.
   g. Wiring diagram.
   h. Degrees temperature rise.
   i. NRTL listing.
3. Sizing and design based upon Acme equipment; Acme catalog numbers utilized for reference.
4. Other acceptable manufacturers: Approved equal units by Hevi-Duty, Jefferson, MGM, or panelboard manufacturer.
5. Contractor is cautioned to verify all physical dimensions of "equal" units prior to accepting quotation for bid.

PART 3 – EXECUTION

3.1 STORAGE

A. Store transformer in a cool, dry space prior to installation.

3.2 INSTALLATION

A. General

1. Stub feeder conduit directly into wiring compartment.
2. Where conduit stubs are impractical, or for suspended installations, connect to feeder by means of flexible metal conduit. Use liquidtight flexible metal conduit in damp areas.
3. Support suspended transformers from structural members of sufficient capacity with rods and trapeze hangers.
4. Examine area to receive transformers to ensure adequate clearance for installation.
5. Provide fused disconnect switch adjacent to transformer when required by NEC Article 240.21(C)(5).

B. Grounding

1. Ground transformer in accordance with NEC Article 250. Refer to NEC 250.30 for grounding separately derived systems.

C. Identification

1. Provide nameplate identification in accordance with Section 260553 for all transformers.
2. Example:

Transformer T2
480-120/208 Volts, 75 KVA
Fed From Panel HP2

D. Concrete Pads

1. Locate floor mounted transformer on concrete pad.
2. Dimensions: 4" high and extend minimum 4" from all sides of transformer.
3. Provided by Division 26. Coordinate installation.

3.3 TESTS

A. Check output voltage and select correct tap to achieve the rated nominal voltage.

END OF SECTION

SECTION 26 2413 - SWITCHBOARDS

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Provide switchboard as shown on Drawings.

B. Description of System

1. Factory assembled, metal enclosed unit for distribution of power from line to feeders, installed and tested in place.

1.2 SUBMITTALS

A. Shop Drawings

1. Submit information in accordance with Section 260500.
2. Show all details, including:
   a. Conduit entrance area.
   b. Electrical ratings.
   c. Nameplate nomenclature.
   d. Single line diagrams.
   e. Bus bar details (size, arrangement and spacing.)
   f. Short circuit withstand rating, and applicable series rating for this particular riser/fault current combination.
   g. Switch rating and location.
   h. Any other pertinent data, including UL 891 listing.

B. Record Manuals

1. Submit information in accordance with Section 260500.
   a. Include fault current available at buss. Fault current calculations shall be based on actual installation criteria (conductor lengths, raceway types, etc.)
2. Include installation and maintenance instructions accompanying equipment.

1.3 QUALITY ASSURANCE

A. Codes and Standards

1. Construct and rate all switchboards in accordance with Underwriters Laboratories Standard 891, National Electrical Code, ANSI and NEMA Standards.

PART 2 – PRODUCTS

2.1 GENERAL

A. Sizing and design based upon Eaton equipment; Eaton catalog numbers used for reference.

B. Other acceptable manufacturers: Approved equal units by panelboard manufacturer.

C. Contractor is cautioned to verify all physical dimensions of "equal" units prior to accepting quotation for bid.

D. NRTL-listed; and "suitable for use as service equipment" when required.

E. Provide barriers in all service switchboards that will isolate service bus bars and terminals from the remainder of switchboard.

F. Feeder risers are schematic only, and not intended to infer lug arrangements. Contractor to indicate desired lug arrangements and sizes on Shop Drawings.

2.2 SWITCHBOARD

A. General

1. NEMA Class 1.
2. Dead front type.
3. Completely metal enclosed.
4. Provide switching devices as shown on Drawings.

B. Switching Device - Fused Disconnect Switch

1. Rating over 600 amperes:
   a. Front operated bolted pressure type.
   b. Fully visible blades in "off" position.
   c. Mechanically interlocked fuse compartment door.
2. Ratings 600 amperes or less:
   a. Quick-make, quick-break with arc quenchers.
   b. Externally operated handle which can be locked in "off" position.
   c. Individual hinged door with interlock and screwdriver operated defeat mechanism.

C. Switching Device - Circuit Breaker

1. Breaker Types:
   a. Under 400 ampere: Molded case, quick-make, quick-break thermal magnetic type, unless otherwise indicated.
   b. 400 ampere and over: Solid-state molded case circuit breakers:
      1) Breakers shall contain electronic sensing, timing and tripping circuits.
         a) Long time current
            (i) Adjustable current pickup
            (ii) Adjustable time delay
         b) Short time current
            (i) Adjustable current pickup
            (ii) Adjustable time delay
         c) Instantaneous current
            (i) Adjustable current pickup
         d) Ground fault.
            (i) Where required by the NEC unless otherwise indicated
            (ii) Adjustable current pickup
            (iii) Adjustable time delay

2) Include maintenance-mode override switch with indicating light for
   a) Devices serving as Service Disconnect.
   b) Devices serving as Main Disconnect of separately derived systems.
   c) 1200 Amp frame and larger.

2. Trip and voltage ratings as shown on Plans.
3. Minimum 65,000 SCCR rated.
   a. NRTL tested and certified series combinations acceptable.
4. Removable from front of switchboard without disturbing adjacent units.

D. Bussing

1. 98 percent conductivity copper.
2. Braced for short circuit stresses equivalent to available fault current.
3. Extend vertical cubicle bussing full height, excluding end gutters.
4. Provide full capacity copper neutral bus entire length of switchboard assembly.
5. Provide full capacity copper equipment ground bus entire length of switchboard assembly.
6. Provide means for future expansion.

E. Enclosure

1. Each section to be of welded and bolted construction, consisting of side frames, horizontal channels and angels, with removable top, sides and front plates.
2. Include bottom base channels and angles to permit jacking or moving section on rollers.
3. All sections to include provisions for mounting lifting angles.
4. Finish: Gray baked enamel over a phosphate rust-inhibiting primer.
5. Unless noted otherwise, nominal 36" wide, 90" high and 24" deep.
6. Gutter spaces 8" minimum on sides and 12" minimum on ends.

PART 3 – EXECUTION

3.1 STORAGE

A. Store switchboard in a cool, dry space prior to installation.

3.2 INSTALLATION

A. General

1. Examine area to receive switchboard to ensure adequate clearance for installation.
2. Install switchboard plumb and level in accordance with manufacturer's installation instructions.
3. Adjust operating mechanisms for free mechanical movement.
4. Tighten bus and lug connections and mechanical fasteners.

B. Identification

1. Identify switchboards and switching devices in accordance with Section 260553.
2. Provide nameplate similar to following example:

Switchboard No. 1
120/208 Volt 3 Ø 4 W
600 Amperes

Minimum 2" X 6" with 3/8" letters. Locate on blank panel near top.

3. Provide nameplate identification in accordance with Section 260553 of these Specifications for all switching devices indicating load served. Locate on front surface of switch door. Do not use schedule numbers, but indicate load served.
4. Provide pressure sensitive tape identification in accordance with Sections 260553 and 262813 of these Specifications for all fusible switches.

C. Concrete Pad

1. Locate switchboard on concrete pad.
2. Dimensions: 4" high and extend minimum 4" from front and sides.
3. Provided by Division 26. Coordinate installation.

3.3 GFPE TESTING

A. Performance Testing

1. Performed when first installed on site, prior to being energized by utility transformer.
2. Primary current injection method shall be used for testing purposes per NEC 230.95-C.
3. Conducted in accordance with manufacturer's instructions.
4. Conducted in presence of manufacturer's representative.
5. Provide letter of verification to Engineer indicating:
   a. Date of test
   b. Name of manufacturer's representative

3.4 INSTRUCTIONS

A. Record instructions and include with Record Manuals in accordance with Section 260500.

3.5 CLEANING

A. **Clean** and **vacuum interior** to remove all wire insulation scraps, dust and dirt.

B. Clean all exposed surfaces immediately prior to final inspection.

END OF SECTION

SECTION 26 2416 - PANELBOARDS

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Provide panelboards where indicated and scheduled.

1.2 SUBMITTALS

A. Shop Drawings:

1. Submit information in accordance with Section 260500. Show all details of:
   a. Lugs.
   b. Locations for grounding bar, neutral bar and directory.
   c. Main bus amperage and arrangement.
   d. Weight and physical dimensions of enclosures.
   e. Cover and lock type.
   f. Quantity of spaces.
   g. Quantity, arrangement, amperage and short circuit withstand ratings in RMS amperes for all circuit breakers.
   h. Any other pertinent data.
   i. Applicable series rating for this particular riser/fault current combination.

B. Record Manuals

1. Submit information in accordance with Section 260500.
   a. Include fault current available at buss. Fault current calculations shall be based on actual installation criteria (conductor lengths, raceway types, etc.)
2. Include installation and maintenance instructions accompanying equipment.

PART 2 – PRODUCTS

2.1 MANUFACTURER

A. Product of same manufacturer.

B. Sizing and design based upon Eaton equipment; Eaton catalog numbers utilized for reference.

C. Other Acceptable Manufacturers.

1. Approved equal units by Siemens or Square D.

D. Contractor is cautioned to verify all physical dimensions of "equal" units prior to accepting quotation for bid.

2.2 GENERAL

A. Provide sub-feed lugs, contactors, main breakers or other equipment as scheduled.

B. Provide copper bus, copper isolated neutral bar and copper grounding bar in all panelboards.

C. Use load centers only where specifically indicated. Provide copper bus with plated aluminum neutral and grounding bar.

D. NRTL-listed, and "suitable for use as service equipment" when required.

E. Feeder risers are schematic only and not intended to infer lug arrangements. Contractor to indicate desired lug arrangements and sizes on shop drawings.

F. Connection from load side of main breaker to panel bus shall be bus bar. Insulated wire and backfed types not acceptable.

G. NRTL-recognized series ratings acceptable, with minimum ratings as specified herein.

2.3 BRANCH CIRCUIT PANELBOARDS

A. Circuit Breakers

1. Bolt-on.
2. Breaker Types:
    a. Under 400 ampere: Quick-make, quick-break, thermal magnetic unless otherwise indicated.
    b. 400 ampere and over: Solid-state molded case circuit breakers:
        1) Breakers shall contain electronic sensing, timing and tripping circuits.
            a) Long time current
                (i) Adjustable current pickup
                (ii) Adjustable time delay
            b) Short time current
                (i) Adjustable current pickup
                (ii) Adjustable time delay
            c) Instantaneous current
                (i) Adjustable current pickup
            d) Ground fault.
                (i) Where required by the NEC unless otherwise indicated
                (ii) Adjustable current pickup
                (iii) Adjustable time delay
        2) Include maintenance-mode override switch with indicating light for
            a) Devices serving as Service Disconnect.
            b) Devices serving as Main Disconnect of separately derived systems.
            c) 1200 Amp frame and larger.
3. Trip indicating.
4. Common trip on multi-pole breakers; handle ties not acceptable.
5. Minimum SCCR rating:
    a. NRTL tested and certified series combinations acceptable.
        1) 10,000 for systems up to 240 volts.
        2) 35,000 for 277/480 volt systems.

6. Single pole 15 and 20 ampere ratings to be NRTL-listed as “Switching Breakers” and carry SWD marking.
7. FIRE ALARM EQUIPMENT
    a. Circuit breakers feeding fire alarm control panels and/or other fire alarm equipment shall be equipped with a pad-locking device capable of locking the circuit breaker in the closed position.

B. Bus Assembly and Temperature Rise

1. Rating: As scheduled.
2. 98 percent conductivity.
3. "Distributed phase" or "Phase sequence" type bus bar connections.
4. Adjacent single pole breakers connected to opposite polarities.
5. Multi-pole breakers installable in any location.
6. Provisions for additional breakers such that field addition of connectors or mounting hardware will not be required.

C. Wiring Terminals

1. NRTL-listed as suitable for type of conductor specified.

D. Circuit Numbering

1. Starting at top, odd numbers in sequence down lefthand side and even numbers in sequence down righthand side.

E. Cabinet

1. Enclose bus assembly in steel cabinet.
2. Wiring gutter sizes and steel gauge in accordance with NEMA and NRTL standards.
3. Fabricate box from galvanized steel or equivalent rust resistant steel.
4. Furnish **without** pre-punched knockouts.

F. Fronts

1. Code gauge, full finished steel with rust inhibiting primer and baked enamel finish.
2. Not removable with door in locked position.
3. Adjustable trim clamps.
4. Concealed steel hinges.
5. Door with tumbler-type cylinder lock, catch and spring-loaded door pull.
6. Flush lock not to protrude beyond door front.
7. Key all locks alike.
8. Circuit directory frame and card with clear plastic covering on inside of door.

G. Manufacturer

1. Eaton Pow-R-Line series.

2.4 POWER DISTRIBUTION PANELBOARDS

A. Circuit Breakers

1. Bolt-on.
2. Breaker Types:
    a. Under 400 ampere: Quick-make, quick-break, thermal magnetic.
    b. 400 ampere and over: Solid-state molded case circuit breakers:
        1) Breakers shall contain electronic sensing, timing and tripping circuits.
            a) Long time current
                (i) Adjustable current pickup
                (ii) Adjustable time delay
            b) Short time current
                (i) Adjustable current pickup
                (ii) Adjustable time delay
            c) Instantaneous current
                (i) Adjustable current pickup
            d) Ground fault, where required, with integral test and reset buttons.
                (i) Adjustable current pickup
                (ii) Adjustable time delay
        2) Main disconnect devices shall include maintenance-mode override.
3. Trip indicating.
4. Common trip on multi-pole breakers; handle ties not acceptable.
5. Equipped with individually insulated braces and protected connectors.
6. Front faces of all circuit breakers to be flush with each other.
7. Affix large, permanent, individual circuit numbers to each breaker in uniform position.
8. Minimum 35,000 SCCR rated.
    a. NRTL tested and certified series combinations acceptable.

B. Bus Assembly and Temperature Rise

1. Rating: As scheduled.
2. Insulated bus structure.
3. 98 percent conductivity.
4. "Distributed phase" or "phase sequence" type bus bar connections.
5. Adjacent single pole breakers connected to opposite polarities.

C. Wiring terminals

1. NRTL-listed as suitable for type of conductor specified.

D. Cabinet

1. Enclose bus assembly in steel cabinet.
2. Wiring gutter sizes and steel gauge in accordance with NEMA and NRTL standards.
3. Fabricate box from galvanized steel or equivalent rust resistant steel.
4. Furnish **without** pre-punched knock-outs.

E. Fronts

1. Minimum 12-gauge, full finished steel with rust inhibiting primer and baked enamel finish.
2. Circuit directory frame and card with clear plastic covering.

F. Safety Barriers

1. As required by UL or other NRTL.

G. Manufacturer

1. Eaton Pow-R-Line series.

2.5 CABLE TIES

A. Thomas and Betts Company "Ty-Rap" or equivalent.

2.6 PLYWOOD BACKING FOR SURFACE MOUNTED PANELBOARDS.

A. 3/4" grade AD, fire-resistant, painted gray (including edges).

PART 3 – EXECUTION

3.1 STORAGE

A. Store panelboards in a cool, dry area prior to installation.

3.2 INSTALLATION

A. General

1. Install where shown on Drawings, plumb and level.
2. Top of trim 6'-3" above finished floor for wall-mounted panelboard.
3. Adjust operating mechanism for free mechanical movement.
4. Conductors neatly dressed and banded with nylon cable ties after final load balancing.
5. From each flush installation, stub three additional 3/4" conduits into nearest accessible ceiling space to provide for future utilization of spare circuits.
6. Provide 3/4" plywood backing for all surface-mounted panelboards.
7. Tighten all lugs in accordance with manufacturer's recommendations.
8. For all fusible distribution panelboards, arrange devices in descending order such that bussed space is at top and largest devices are at bottom.
9. Provide individual terminal or lug for each wire. Multiple wires to common terminal, or several terminals for single stranded conductor not acceptable.

B. Identification

1. Identify panelboards and directories in accordance with Section 260553.
2. Provide nameplate similar to following example:

PANEL L6
120/208 VOLT 3∅ 4W
2" C – 4 #3/0
FED FROM SWBD #1

3. When required, provide identification as per NEC 210.5(C) at each branch circuit panelboard.

C. Concrete Pad

1. Locate floor mounted panelboard on concrete pad.
2. Dimensions: 4" high and extend 4" from front and sides.
3. Provided by Division 26. Coordinate installation.

3.3 TESTS

A. Balancing Load

1. Circuiting shown on Drawings is designed to produce equal loading on all phases.
2. Under actual operating, check and make circuit adjustments as required to produce balanced condition.

B. GFPE Testing

1. Performed when first installed on site, prior to being energized by utility transformer.
2. Primary current injection method shall be used for testing purposes per NEC 230.95-C.
3. Conducted in accordance with manufacturer's instructions.
4. Conducted in presence of manufacturer's representative.
5. Provide letter of verification to Engineer indicating:
   a. Date of test.
   b. Name of manufacturer's representative present.

3.4 CLEANING

A. **Clean** and **vacuum interior** to remove all wire and insulation scraps, dust and dirt.

B. Clean all exposed surfaces immediately prior to final inspection.

END OF SECTION

SECTION 26 2713 – ELECTRIC SERVICE

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Provide electrical service from Rough Rider Electric's point of connection to main switch.

B. Description of System

1. 208/120 V, 3 Phase, 4 Wire

PART 2 – PRODUCTS

2.1 METERING

A. CT metering.

B. Utility company to furnish all instrument transformers and meters.

C. Meter Sockets: Provide as required by utility company.

2.2 CURRENT TRANSFORMER CABINETS

A. Construction

1. NEMA 3R.
2. 14-gauge galvanized steel.
3. Gray enamel finish, or as required by serving utility.
4. Single hinge cover with combination padlock and sealing wire.

B. Bus Assembly

1. Amperage as indicated on Drawings.
2. Copper bus bar.
3. Glaskyd insulator supports.
4. Combination disconnect/connector kit.
5. Window CT bus link kit.
6. Compression lugs.

C. Combination Back Pan

1. Galvanized steel
2. Prepunched to accept bar type current transformers.

D. Manufacturer: American Midwest Power, Inc., Electro Mechanical Industries, Inc., or States Electric Mfg. Co.

2.3 TRANSITION CABINETS

A. Construction

1. 12-gauge galvanized phosphated steel.
2. Primed and painted one coat forest green enamel.
3. Lift off covers - both sides.
4. Padlocking handle with two point latch mechanism.
5. Penta head sealing bolt.
6. No trough openings, or furnish NEMA 3R cover plates.

B. Bus Assembly

1. Amperage as indicated on Drawings.
2. Copper bus bar.
3. Prepunched to NEMA standards for up to five utility company lugs.
4. Compression lugs on load side.
5. Ground stud.
6. Provision for bar type CT's.

C. Manufacturer: Shallbetter CB series, or approved equal by American Midwest Power, Inc., Electro Mechanical Industries, Inc., or States Electric Mfg. Co.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Verify with utility company prior to Bid all specific equipment requirements, installation requirements and fees particular to this service installation and make allowances thereto.

B. Include in Bid all utility company fees and charges associated with service installation.

C. Include in Bid all miscellaneous lugs, ground rods, site and pad conduits, sleeves, and other appurtenances required for service installation and not provided by utility company.

D. Transformer and Equipment Pads

1. Concrete pads provided by Division 26.
2. Size per utility company requirements.
3. Coordinate installation.

E. Contractor totally responsible for all utility company coordination, metering equipment placement, and transformer location, with respect to service installation.

F. Service installation shall comply with utility company rules and regulations.

G. Cabinets

1. Install cabinets in accordance with Code, product listing and manufacturer's recommendations.
2. Install where shown on Drawings.
3. Plumb and level.
4. Top of trim 6'-3" above finished floor.

3.2 IDENTIFICATION

A. Identify cabinets with nameplates in accordance with Section 260553.

B. Inscription as directed by Engineer.

C. Provide available fault current calculations for cabinets based on actual installation criteria (conductor lengths, raceway types, etc.). Include calculation information in Record Manuals.

3.3 CLEAN UP

A. **Clean** and **vacuum interior** to remove all wire and insulation scraps, dust and dirt.

B. Clean all exposed surfaces immediately prior to final inspection.

END OF SECTION

SECTION 26 2726 – WIRING DEVICES AND DEVICE PLATES

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Provide wiring devices complete with device plates of matching or specified color. Wiring devices include receptacles for the connection of portable equipment and switches used for the control of both lighting and fractional horsepower motor loads. Also included are dimmers, occupancy sensors, photoelectric switches and time switches.

B. Work Installed But Furnished by Others

1. Where indicated, install devices furnished by other Divisions of this Specification.

1.2 SUBMITTALS

A. Shop Drawings

1. Submit information in accordance with Section 260500.

B. Record Manuals

1. Provide information in accordance with Section 260500.
2. Include installation and maintenance instructions accompanying the equipment.

PART 2 – PRODUCTS

2.1 GENERAL

A. Device color: Gray or as selected by Architect. Verify with Architect. (Exception: Red devices on emergency circuits where applicable).

B. All devices shall be of the same manufacturer, except where specifically noted otherwise with the phrase "NO SUBSTITUTION".

2.2 SWITCHES

A. AC Toggle and Keyed Switches

1. 20-ampere 120/277 volt AC and HP rated.
2. Industrial Grade.
3. Color coded face or body by amperage.
4. Screw pressure plate back wire and side wire.
5. Federal Spec WS-896 listed.
6. Acceptable Manufacturers:
   a. Cooper — 2220 series
   b. Hubbell — 1220 series

c.	Leviton	1220 series
d.	Pass & Seymour	PS20AC series

B. Pilot Light Switches

1. Neon lamp in red toggle handle, lit in "on" position.
2. 20 ampere, 120/277 volt AC rated.
3. Manufacturer: As listed above.

C. Time Switches

1. Two Circuit SPST switching, voltage rating as required.
2. Digital display with 7-Day programming.
3. Non-volatile program memory (battery backup unacceptable).
4. Manufacturer: Intermatic #ET2725 series.
5. Other acceptable manufacturer: Tork.
6. Special units as shown on Drawings.

D. Remote Photoelectric Switches

1. Threaded swivel mounting with locking nut and neoprene gasket.
2. Light level adjustment slide.
3. Activation: 1-5 footcandle on, 3-15 footcandle off.
4. Manufacturer: Intermatic #K4200 series, wattage and voltage as required.
5. Other acceptable manufacturers: Paragon, Area Lighting Research, Precision, or Tork.

E. Spring Wound Timer Switch

1. As shown on Drawings.
2. Manufacturer: Intermatic.
3. Other acceptable manufacturers: Area Lighting Research, Rhodes Mark Time, or Tork.

F. Occupancy Sensors

1. Ceiling Mount – Line Voltage
   a. Self-contained line voltage unit with no external relays or power packs required.
   b. Passive dual technology sensing combining passive infrared and ultrasonic/microphonic technology. Selective for initial and maintained triggering.
   c. Rating: 120 VAC @ 800 watts, 277 VAC @ 1200 watts, electronic ballast rating. No minimum load requirements.
   d. Ceiling-mount with 360° conical pattern coverage.
   e. Adjustable time delay, from 5 to 20 minutes.
   f. Automatic adjustment option for continuous time of day usage monitoring with automatic off delay adjustment.
   g. Integral light level sensor to prevent turning lights on at selected light level between 10 and 300 footcandles.
   h. LED activity Indicator.
   i. Manufacturer: WattStopper #DT-355, Sensorswitch CMR-PDT series, Leviton ODC series, Hubbell OMNIDT-BP series, or approved equal.
2. Wall Mount
   a. Self-contained line voltage unit with passive infrared sensing.

b. Rating: 120 VAC @ 800 watts, 240/277 VAC @ 1200 watts, electronic ballast rating. No minimum load requirements
c. PIR collector beams view out horizontally 35 feet in a wall-to-wall pattern, with a 20-foot effectiveness for small hand or body motions.
d. Adjustable time delay, from 5 to 20 minutes, with "OFF" override switch.
e. Automatic adjustment option for continuous time of day usage monitoring with automatic off delay adjustment.
f. Bypass mode to allow override button to act as a standard on-off switch in case of sensor failure.
g. Vandal resistant lens.
h. LED activity Indicator.
i. Multi-way version:
   1) Simultaneous load control from up to four device locations.
j. Dual-level version (ab switching):
   1) Two separate relays with dual override switches.
   2) Independent Auto or Manual mode per relay.
k. Manufacturer: WattStopper PW series, Sensorswitch WSX series, Leviton OSSMT series, Hubbell LHIR series, or approved equal.

3. Wall Mount with 0-10V Dimming
   a. Self-contained line voltage unit with passive infrared sensing.
   b. Rating: 120 VAC @ 800 watts, 240/277 VAC @ 1200 watts. No minimum load requirements.
   c. Class 1 control of 0-10 Volt LED dimming for full range dimming control.
   d. PIR collector beams view out horizontally 35 feet in a wall-to-wall pattern, with a 20-foot effectiveness for small hand or body motions.
   e. Adjustable time delay, up to 30 minutes, with "OFF" override switch.
   f. Multi-location capable.
   g. Manufacturer: WattStopper PW-311, Sensorswitch WSX-D, Hubbell LHD-IRS series, or approved equal.

2.3 RECEPTACLES

A. General Purpose

1. 20 ampere, self-grounding, NEMA 5-20R, industrial specification grade.
2. Nylon face with finder grooves and compact body.
3. Minimum 0.032" triple wipe brass contacts.
4. Corrosion resistant steel strap interlocked with face and body.
5. Screw pressure plate back wire and side wire.
6. Federal Spec WC-596 listed.
7. Acceptable Manufacturers:

a.	Cooper	5362
b.	Hubbell	5362
c.	Leviton	5362
d.	Pass & Seymour	CRB5362

B. Tamper Resistant

1. 20 ampere, self-grounding, NEMA 5-20R.
2. Energized only when two blade or three blade grounding cord cap is properly inserted.
3. Use in all locations indicated in Part 406.12 of the National Electric Code.
4. Acceptable Manufacturers:

a.	Cooper	TRBR20

b.	Hubbell	CR20TR
c.	Leviton	CR20TR
d.	Pass & Seymour	TR20

C. GFCI

1. 20 ampere, feed-through type.
2. Two utilization points per device, with vertical orientation.
3. Use Tamper Resistant version in all locations indicated in Part 406.12 of the National Electric Code
4. Manufacturer: As listed above.

D. Combination Duplex and USB Charging

1. 20 ampere, Decora style.
2. Two utilization points per device, with vertical orientation.
   a. Includes one USB-A port.
   b. Includes one USB-C port.
3. 5 ampere, 5 Volt USB output.
4. Tamper resistant style in all locations indicated in Part 403.12 of the National Electric Code.
5. Manufacturers:

a.	Cooper	TRUSBAC20
b.	Hubbell	USB20AC5
c.	Leviton	T5833
d.	Pass & Seymour	TR20USBAC.

E. Damp & Wet Locations

1. All 15 and 20 ampere, 125 and 250 volt non-locking receptacles shall be listed weather-resistant type as per NEC 406.9(A) and 406.9(B)(1).
2. Manufacturer: As listed above.

2.4 DIMMERS

A. LED

1. Control of 0-10 Volt LED dimming for full range dimming control.
2. Wattage as required by luminaire count in room.
3. Integral power pack for positive off.
4. Provide separate power pack if required by total room wattage.
5. Manufacturer: Lutron Diva Series #DVSTV.

2.5 DEVICE PLATES

A. Flush Interior

1. Opening for device intended.
2. 430 or 302/304 stainless steel, or as selected by Architect.
3. Where plastic plates are selected by Architect, provide thermoplastic type.
4. Manufacturer: Cooper, Hubbell, Leviton and Pass & Seymour.

B. Surface Interior

1. 1/2" raised cover

C. Damp & Wet Locations

1. Damp locations:
   a. Refer to NEC 406.9(A).
   b. Die-cast aluminum construction with stainless steel springs.
   c. Unless indicated otherwise on the Drawings, Manufacturer: Pass & Seymour #4500 series or equivalent.
2. Wet locations:
   a. Refer to NEC 406.9(B).
   b. Unless indicated otherwise on the Drawings, Manufacturer: Red Dot #CKMU (horizontal) or #CKMUV (vertical), or approved equal by Hubbell.

PART 3 – EXECUTION

3.1 INSTALLATION

A. General

1. Install device and plates where shown on Drawings in accordance with Code, product listing and manufacturer's recommendations.
2. Refer to Section 260534-3.1C for mounting heights.
3. Plumb and level.
4. Tight to wall.
5. Thoroughly cover wall opening around device.
6. Replace all devices and plates that become discolored or burned during construction.
7. Provide blank plates for unused openings.
8. Connect wiring devices by means of single conductor tails. Multiple wire connections not acceptable.
9. Tighten unused connection screws.

B. Identification

1. Identify wall switches which control lighting or equipment not in sight.
2. Refer to Section 260553-3.1C.

C. Receptacles

1. Vertical mounting with grounding pole at bottom.
2. Provide GFCI receptacles at NEC 210.8 locations.

D. Dimmers

1. No common neutrals.
2. Individually mounted: No gang mounting.
3. Do not remove any fins.

E. Photoelectric Switches

1. Install on roof, in center of structure where viewing from ground is minimal.
2. Verify exact location with Architect.
3. Penetrate roof with 3/4" RGSC, securely fastened to structure.
4. Provide flashing to maintain roof integrity.
5. Mount 18" above finished roof surface.
6. Make connections in weatherproof junction box.

F. Occupancy Sensors

1. Provide adequate supports to any structures, ceilings and grid system to safely attach sensors.
2. Mount external power packs (required only for low voltage sensors) within junction box in accessible ceiling space.
3. Verify operating parameters with Engineer.

3.2 TESTS

A. Proper operation of lighting switches, dimmers and occupancy sensors.

B. Duplex Receptacles

1. Proper connections.
2. Test all receptacles with NRTL listed receptacle circuit tester similar to Bryant #5266-PT, or Ideal #EZ Check.

3.3 INSTRUCTIONS

A. Instruct Owner's personnel in proper operation, setting, and maintenance of time switches, dimmers, occupancy sensors, and GFCI receptacles.

END OF SECTION

SECTION 26 2813 - FUSES

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Provide all fuses as required.

B. Work Furnished But Not Installed

1. Provide spare fuses for all sizes and classes required.
2. Quantity: 10%, with a minimum of three each rating, including motor starter control transformer fusing.

1.2 SUBMITTALS

A. Record Drawings

1. Indicate actual class, type and size of fuse installed in each device.

B. Record Manuals

1. Submit information in accordance with Section 260500.

PART 2 – PRODUCTS

2.1 FUSES

A. 600 Amperes and Less Protecting Feeders or Combination Motor/Branch Circuit Loads.

1. UL-listed, Class RK-1.
2. Manufacturer: Bussmann LPN-RK/LPS-RK, Littelfuse LLN-RK/LLS-RK, or Brush LEN-R/LES-R.

B. Elevators

1. UL-listed, Class J.
2. Manufacturer: Bussmann LPJ-SP or Littelfuse JTD-ID.

C. Motor Starter Control Transformers

1. As recommended by manufacturer.

D. Plug Fuses

1. Dual element, UL-listed Type S with adapter.
2. Use only as indicated on Drawings for fused toggle switches.

2.2 SPARE FUSE CABINET

A. Construction

1. Welded steel or .080 gauge aluminum.
2. Gray enamel finish.
3. Locking handle/cylinder lock.
4. Integral shelving.

B. Size: Minimum 30" H x 24" W X 12" D.

C. Acceptable Manufacturers: American Midwest Power SFC 36, B-Line 243012FC, Bussmann SFC, Gould Shawmut GSFC, or Littelfuse LSFC.

2.3 PLYWOOD BACKING

A. 3/4" grade AD, fire resistant, painted gray (including edges).

PART 3 – EXECUTION

3.1 STORAGE

A. Store fuses in a cool, dry space prior to installation.

3.2 INSTALLATION

A. General

1. Install fuses in accordance with Code, product listing and manufacturer's recommendations.
2. Verify equipment fuse sized for load prior to installation.
3. All fuses shall be of same manufacturer.
4. Do not mix fuse classes in individual applications.
5. Fuses are not required for switchboard devices marked "Spare".

B. Spare Fuse Cabinet

1. Top of trim 6'-3" above finished floor.
2. Provide ¾" plywood backing.

C. Identification

1. Indicate on inside cover with pressure sensitive tape the size, voltage and type of fuse furnished for each device.

END OF SECTION

SECTION 26 2816 – ENCLOSED SWITCHES & CIRCUIT BREAKERS

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Provide disconnects where shown on Drawings or required by Code.
2. Provide enclosed circuit breaker where shown on the Drawings.

1.2 SUBMITTALS

A. Shop Drawings

1. Submit information in accordance with Section 260500.
2. Indicate on submittal exact motor or equipment served.
3. Show all details including electrical ratings, enclosure dimensions and other pertinent data.

B. Record Manuals

1. Submit information in accordance with Section 260500.
2. Include installation and maintenance instructions accompanying the equipment.

PART 2 – PRODUCTS

2.1 DISCONNECT SWITCHES

A. Switch Interior

1. Positive “off” position.
2. Lugs: NRTL-listed for aluminum and copper cable.
3. Plated current carrying parts.

B. Switch Mechanism

1. Quick-make, quick-break operating handle and mechanism.
2. Integral part of box.
3. Enclosures: Code gauge sheet steel (NEMA 1) or Code gauge galvanized steel (NEMA 3R).
4. Treat with rust-inhibiting phosphate primer.
5. Finish: Baked enamel.

C. Ratings

1. 250 or 600 volt.
2. Heavy duty.
3. Horsepower rated.
4. NRTL-listed "Suitable for Use as Service Equipment" when required.

D. Fusing

1. NRTL-listed rejection feature.
2. Reject all fuses except UL-listed Class R.

E. Manufacturer: Panelboard manufacturer.

2.2 ENCLOSED CIRCUIT BREAKERS

A. Breaker Types:

1. Under 400 ampere: Quick-make, quick-break, thermal magnetic unless otherwise indicated.
2. 400 ampere and over: Solid-state molded case circuit breakers:
    a. Breakers shall contain electronic sensing, timing and tripping circuits.
        1) Long time current
            a) Adjustable current pickup
            b) Adjustable time delay
        2) Short time current
            a) Adjustable current pickup
            b) Adjustable time delay
        3) Instantaneous current
            a) Adjustable current pickup
        4) Ground fault
            a) Where required by the NEC unless otherwise indicated
            b) Adjustable current pickup
            c) Adjustable time delay
    b. Include maintenance-mode override switch with indicating light for
        1) Devices serving as Service Disconnect.
        2) Devices serving as Main Disconnect of separately derived systems.
        3) 1200 Amp frame and larger..
3. Trip indicating.
4. Minimum SCCR rating:
    a. 10,000 for systems up to 240 volts.
    b. 35,000 for 277/480 volt systems.

B. Manufacturer: Panelboard manufacturer.

2.3 PLYWOOD BACKING FOR SURFACE MOUNTED SWITCHES

A. For interior locations, mount on 3/4" AD, fire-resistant, painted gray (including edges).

PART 3 – EXECUTION

3.1 STORAGE

A. Store disconnect switches or enclosed circuit breakers in a cool, dry space prior to installation.

3.2 INSTALLATION

A. General

1. Install all required disconnect switches or enclosed circuit breakers in accordance with Code, product listing and manufacturer's recommendations.
2. Plumb and level.
3. Tighten lugs in accordance with manufacturer's recommendations.

B. Identification

1. Identify disconnect switches or enclosed circuit breakers in accordance with Section 260553.
2. Nameplate required for all disconnect switches. Nameplate to include load served, voltage, horsepower or MCA rating, and fuse size. Nameplate to be installed inside of cover on exterior disconnect switches.

   Example:

   RT-1
   480 Volt, 3 Ø
   35 MCA, 40 A Fuses

3. Do not use schedule number, but indicate load served.
4. Pressure sensitive tape identification for disconnect switches containing fuses.
5. Voltage markers on all disconnect switches containing system voltages in excess of 250 volts to ground.

3.3 TESTING

A. GFPE Testing

1. Performed when first installed on site, prior to being energized by utility transformer.
2. Primary current injection method shall be used for testing purposes per NEC 230.95-C.
3. Conducted in accordance with manufacturer’s instructions.
4. Conducted in presence of manufacturer’s representative.
5. Provide letter of verification to Engineer indicating:
   a. Date of test.
   b. Name of manufacturer’s representative present.

3.4 CLEANING

A. **Clean** and **vacuum interior** to remove all wire and insulation scraps, dust and dirt.

B. Clean all exposed surfaces immediately prior to final inspection.

END OF SECTION

SECTION 26 2822 – ELEVATOR WIRING

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Power service connection.
2. Lighting service connection.
3. Telephone (voice) cabling.

B. Work not included

1. Telephone (located with elevator cab).
2. Control and interlock wiring.
3. Car normal and emergency lighting.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Disconnect Switches

1. Main power
   a. Enclosed in single NEMA 1 enclosure.
   b. Fusible switch with shunt trip capabilities.
   c. Amp rating as scheduled on Drawings.
   d. Class J fuses.
   e. Control power transformer with fuses and blocks.
   f. Fire safety interface relay with 120 VAC coil.
   g. Key to test switch.
   h. Green pilot light – “ON”.
   i. Two mechanically interlocked NO/NC auxiliary contacts, Form C, 120 VAC-rated.
   j. Fire alarm voltage monitoring relay (to monitor shunt trip voltage).
   k. Integral Type 1 Surge Protective Device.
   l. Manufacturer: Bussmann Power Module Switch PS series or Littelfuse Power-Switch LPS series.
2. Lighting Service
   a. Minimum rating 115 volts 20 amperes.
   b. Lockable enclosed circuit breaker, or fusible disconnect as per Specification Section 262816.

B. Pit Light

1. Refer to Section 265100.
2. LED strip fixture with lens and wire guard.
3. Minimum of 3,500 delivered lumens.

PART 3 – EXECUTION

3.1 PREPARATION

A. Coordinate entire installation with elevator system installer prior to installation of equipment.

B. Provide available fault current calculations at elevator machine based on actual installation criteria (conductor lengths, raceway types, etc.). Calculations shall incorporate the current limiting effects of fuses supplied with local power module/disconnecting means. Include calculation information in Record Manuals.

3.2 INSTALLATION

A. Power Service

1. Verify exact disconnect location in elevator machine room with elevator system installer.
2. Provide power circuitry to elevator control panel as directed by elevator system installer.

B. Lighting Service

1. Verify exact disconnect location in elevator machine room with elevator system installer.
2. Provide separate 120 volt 20 ampere circuit to elevator control panel as directed by elevator system installer.

C. Elevator Pit

1. Verify pit light location with elevator system installer.
   a. Light location shall provide at least 5 foot-candles on the entire floor area of the pit. Provide multiple pit lights if required.
2. Provide surface GFCI receptacle and toggle switch near pit access ladder.
   a. Wire toggle switch to line side of GFCI receptacle, for control of pit light (non-GFCI).
3. Provide separate 120 volt 20 ampere circuit.

D. Telephone

1. Provide one Category cable, as specified in Section 271500, in 3/4" conduit from telephone service.
2. Stub into elevator machine room or machine space as directed by elevator system installer.

E. Machine Room or Machine Space (machine room-less application)

1. Lighting as shown on the Drawings.
2. Receptacles shall be GFCI.
3. Provide a dedicated 120 volt 20 ampere circuit for the machine room/space lighting and a dedicated 120 volt 20 ampere circuit for the machine room/space receptacles.

F. Fire Alarm System Interface

1. General
   a. Fire alarm system interface shall initiate elevator Phase I Emergency Recall Operation in accordance with ASME A17.1 and NFPA 72.

b. Provide three elevator control outputs from the fire alarm system to the elevator control panel. The designated and alternate lobbies shall be determined by the local inspection authority.
    1) Designated Level Output: The first output shall be activated by the smoke detector(s) located in elevator lobbies other than the designated elevator lobby to initiate recall to the designated lobby.
    2) Alternate Level Output: The second output shall be activated by the smoke detector(s) located in the designated elevator lobby to initiate recall to the alternate level.
    3) Machine Room Output: The third output shall be activated by the elevator hoistway and/or machine room or machine space smoke detector(s) to initiate recall to the designated lobby.
        a) If the machine room or machine space is located at the same level as the designated lobby, the machine room or machine space smoke detector(s) shall activate the Alternate Level Output.
        b) In multi car applications, each hoistway detector shall activate a distinct warning output to all adjacent cars.
c. Elevator control outputs shall consist of separately controlled NO/NC dry contacts from fire alarm individual addressable relay module(s) (Relay IAM).
d. Install elevator control circuits from Relay IAMs to elevator control panel as directed by elevator system installer.
e. Elevator control panel connection by elevator system installer.

2. Hoistway smoke detector
    a. Ceiling-mounted at top of hoistway.
    b. Provide ceiling-mounted remote alarm indicator/test switch in top floor of adjacent elevator lobby area.
3. Lobby smoke detector
    a. Ceiling–mounted within 21 feet from centerline of elevator door opening.
    b. Locations as indicated on the Drawings.
4. Machine room smoke detector
    a. Ceiling-mounted.
5. Machin space smoke detector (machine room-less application)
    a. Mounted on back-plane of machine equipment area. See detail on drawings.

G. Fire Sprinkler System Interface

1. When required, refer to "Elevator Fire Sprinkler/Power Module Switch Interface” Detail on the Drawings.

H. Entire installation to comply with elevator submittal drawings.

3.3 TESTING

A. Prior to final inspection, verify that elevator electrical systems and fire alarm interfaces are in proper working condition, free from false alarms.

B. Coordinate scheduling of all tests for elevator interfaces with elevator supplier, Local Fire Marshall or Fire Chief, and Owner.

END OF SECTION

SECTION 26 2913 – MOTOR STARTERS

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Provide motor starters where shown and scheduled, or as required by Code.

B. Work Installed But Furnished Under Other Directives

1. Refer to Section 260500, Article 1.1, Paragraph D for extent of control devices furnished in other Divisions.

1.2 SUBMITTALS

A. Shop Drawings

1. Submit information in accordance with Section 260500.
2. Show all details including electrical ratings, controls, schematic wiring diagrams, enclosure dimensions and other pertinent data.
3. Indicate on submittal exact motor or equipment served.

B. Record Manuals

1. Submit information in accordance with Section 260500.
2. Include installation and maintenance instructions accompanying the equipment.

PART 2 – PRODUCTS

2.1 GENERAL

A. Product of same manufacturer.

B. Sizing based upon Eaton equipment.

C. Other acceptable manufacturers: Approved equal units by Allen Bradley, Schneider, and Siemens.

D. Contractor is cautioned to verify all physical dimensions of "equal" units prior to accepting quotation for Bid.

2.2 SINGLE PHASE MOTORS WITH INTEGRAL OVERLOAD PROTECTION

A. Horsepower rated toggle switch, pilot handle where not in sight from motor.

2.3 SINGLE PHASE MOTORS WITHOUT INTEGRAL OVERLOAD PROTECTION

A. Manual Motor Starter

1. Manually operated toggle switch with integral overload protection.
2. Rendered inoperative unless thermal unit is in position.
3. Provide pilot light for manual starters not in sight from motor.
4. Provide flush-mounted starters with stainless steel plates.
5. NEMA 1 enclosures for surface-mounted starters unless otherwise required by environment.

B. Fused Toggle Switch

1. 4" square box mounting.
2. Complete with fuse adapter and plug fuse of correct rating.
3. Manufacturer: Bussmann or Reliance.
4. **Use only where specifically shown.**

2.4 THREE PHASE AND SPECIFIED SINGLE PHASE MOTORS

A. Across-the-line

1. Magnetic type, non-reversing unless otherwise scheduled.
2. Rated in accordance with NEMA standards, sizes and horsepower ratings.
3. Provide combination fusible unit with Class R fuse holders, where disconnect and starter are shown at the same location.
4. Minimum size: NEMA size 0.
5. Manufacturer's series: Eaton Freedom series, or approved equal units by Allen Bradley 512 series, Schneider 8538 series or Siemens Class 17 series.

6. Control
   a. 120 volt control transformer
   b. Control fusing:
      1) 250 volt - in accordance with NEC.
      2) 600 volt - primary and secondary fusing regardless of VA rating of control transformer.
   c. Cover-mounted devices for single-speed starters:
      1) Transformer operated LED green pilot light for running indication, with push-to-test feature.
      2) H-O-A selector switch, unless otherwise scheduled.
   d. Cover-mounted devices for two-speed starters:
      1) Transformer operated LED pilot lights for running indication, with push-to-test feature: Green for low speed, amber for high speed).
      2) High-low-off-auto selector switch, unless otherwise scheduled.
   e. Molded coil construction.

7. Overload Protection – exterior locations

   a. Resettable overload protection on all phases.
   b. Class 20 construction.
   c. Starter inoperative if one or more overload units removed.

8. Overload Protection – interior locations

   a. Self-powered.
   b. Solid state construction with adjustable overload protection on all phases.
   c. Manual reset with capability for remote reset function.
   d. Phase loss protection.

e. Ambient-insensitive within operating range of -25°C to 55°C.
f. Solid state construction, Class 20.
g. Starter inoperative if overload unit is removed.

9. Electrical Interlocks

a. Space for minimum three, any arrangement NO or NC.
b. Quantity: Two NO per starter.

B. Solid State Starters

1. Control and interlock options as previously indicated.
2. Run bypass contactor.
3. Class 20 overload protection.
4. Heavy-duty rating.
5. Temperature: NRTL-listed for -30 to 50°C ambient.
6. Rated for 4 starts per hour
7. Adjustable ramp times, torque control, and kick start.
8. Solid state reduced voltage type: Eaton 801+ Series.
9. Other acceptable manufacturers: As previously indicated.

C. Variable Frequency Drive

1. Normal duty packaged combination unit, non-bypass type in fan/filter cooled NEMA 1 enclosure.
2. Integral disconnect shall be Fused switch type. 100K AIC Rated.
3. Full numeric operator keypad with LCD display interface mounted on dead front cover.
4. Hand-Off-Auto selector switch.
5. Transformer operated LED amber pilot light for fault indication, with push-to-test feature
6. Integral 3% Line reactor.
7. Variable Torque.
8. Selectable switching frequency.
   a. 2kHz to 12k Hz
   b. Automatic reduction under excessive heat sink temperatures.
9. Minimum I/O
   a. 5 Digital Inputs
   b. 2 Analog Inputs
   c. 2 NO/NC Relay Outputs
   d. 1 Analog Output
10. Communications protocol
    a. Ethernet/IP, Modbus, BACnet.
11. Manufacturer: Eaton PowerXL DG1 Series, Allen Bradley Powerflex 753 Series or Schneider Altivar 61 Series.

2.5 THREE PHASE POWER MONITOR

A. Provide for all three phase motors larger than two horsepower, and all three phase compressor equipment.

1. Not required for motors served by solid state starters or variable frequency drives.

B. Line voltage to match system.

C. Operating parameters:

1. Trip: 90% rated voltage on any or all phases.
2. Reset: 93% rated voltage on all three phases.
3. Dead band between trip and reset: 3%.
4. Repeat accuracy: 1% maximum at 0-70°C.
5. Trip Delay Time: Two seconds.
6. Reset: Two seconds.
7. Output contact rating: Pilot Duty, 470 VA @ 600 VAC.
8. Transient Protection: 2500 Volts for 10 MS.

D. Special Options

1. NEMA 1 or 3R enclosure as required.
2. Adjustable Time Delayed Restart: 30-300 seconds. Set at 300 seconds.

E. Manufacturer: Motor Saver Model 350.

F. Other acceptable manufacturers: Eaton #D65 series.

2.6 PLYWOOD BACKING FOR SURFACE MOUNTED STARTERS

A. 3/4" grade AD, fire-resistant, painted gray (including edges).

PART 3 – EXECUTION

3.1 STORAGE

A. Store motor starters in cool, dry space prior to installation.

3.2 INSTALLATION

A. General

1. Plumb and level.
2. Install motor starters in accordance with Code, product listing and manufacturer's recommendations.
3. Tighten all lugs in accordance with manufacturer's recommendations.
4. Verify correct size overload protection with motor nameplate data and manufacturer's recommendations.
5. Where power factor correction is specified for connection to motor terminals (i.e. load side of overload units), reduce overload rating as per manufacturer's recommendations.
6. Provide 3/4" plywood backing where several controls are shown grouped for surface mounting.

B. Identification

1. Identify motor starters in accordance with Section 260553.
2. Provide two nameplates for all motor starters: One for starter, other for equipment. Do not mount equipment nameplate on motor. Rather, mount on equipment, in visible location near motor.
3. Do not use motor schedule numbers, but indicate motor or load served.

4. Provide pressure-sensitive tape identification in accordance with Section 260553 and 262813 for all motor starters containing fuses.
5. Indicate proper thermal overload unit by circling correct number on chart affixed to cover of starter.
6. Provide voltage markers for all motor starters containing a system voltage in excess of 250 volts to ground.
7. Voltage markers not required for motor starters which form a part of a motor control center as specified in Section 262419.

3.3 TESTS

A. Proper operation.

B. Correct rotation.

C. Solid state motor starters

1. Furnish letter of verification to Engineer indicating solid state motor starters have been tested by manufacturer's representative.
2. List date of test and name of manufacturer's representative.

3.4 INSTRUCTIONS

A. Manufacturer's representative shall instruct Owner in proper maintenance and testing of solid state motor starters. Include name of Owner's representative in letter of verification.

B. Record instructions and include with Record Manuals in accordance with Section 260500.

3.5 CLEANING

A. **Clean** and **vacuum interior** to remove all wire and insulation scraps, dust and dirt.

B. Clean all exposed surfaces immediately prior to final inspection.

END OF SECTION

SECTION 26 3213 -GENERATOR SET

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. NFPA 110 Level 1, standby-rated, engine-generator set to supply emergency power to selected loads when normal power is not available.

B. Description of System

1. Upon failure of normal power, automatic transfer switch shall cause engine to start automatically, attain rated voltage and frequency, and transfer load.

1.2 SUBMITTALS

A. Submittals for Prior Approval to Quote

1. Refer to Section 260500 for "Prior Approval to Quote" procedure.
2. Clearly indicate following on cover letter of submittal:
   a. Combustion air CFM based on 110°F ambient.
   b. Cooling air CFM based on 110°F ambient.
   c. External static pressure capability of pusher fan (inches of water).
   d. Unobstructed volume of radiator core available for cooling, cubic feet.
   e. Heat rejection through cooling system.
   f. Heat rejection to generator room.
   g. Exhaust pipe size for particular distance of run.
   h. Muffler dimensions.
   i. Lift capacity of fuel pump.
   j. Location of nearest maintenance and repair facility under the ownership of the supplier.
   k. Any exceptions taken to technical requirements of Part 2, this Section.

B. Shop Drawings

1. Submit information in accordance with Section 260500.
2. Include complete data for maintaining and operating unit:
   a. Fuel requirements.
   b. Lubrication requirements.
   c. Exercising.
   d. Tests to be performed.
   e. Spare parts list.
   f. Trouble shooting guide.
   g. Description of operation.
3. Provide multiple copies. One to remain with generator and the other copies for Record Manuals.

C. Record Manuals

1. Submit information in accordance with Section 260500.

2. Include installation and maintenance instructions accompanying equipment.
3. Include written warranty and maintenance agreements.

1.3 QUALIFICATIONS

A. Manufacturer: Company specializing in package engine generator sets with minimum five years documented experience.

B. Supplier: Authorized distributor of engine generator manufacturer with service facilities within 350 miles of the project site.

PART 2 – PRODUCTS

2.1 GENERATOR SET

A. General

1. Fuel: #2 diesel or #1/winter blend as directed by Owner.
2. Engine driven, inline or V-type 4-cycle/stroke, 1,800 RPM with electronic governor.
3. Complies with current EPA regulations for nonroad engines of required hp.
4. Liquid cooled.
5. Furnish fuel pump, fuel filter with integral heater, and flexible fuel line.
6. Flexible fuel line to be braided metal, size as required.
7. Integral radiator with duct adapter.
8. Anti-vibration mounting pads between engine/alternator and base frame.
9. Heater
    a. Water jacket type.
        1) Thermostatically controlled.
        2) Sized to maintain adequate block temperature to ensure prompt starting.
        3) Provide engine mounted isolation valves to facilitate removal and replacement.
        4) Provide one per in-line engine and one per bank for vee type engines.
        5) Manufacturer: Kim Hotstart or equivalent by generator supplier.
10. Safety Shutdowns.
    a. NFPA 110 Level 1.
    b. Dedicated shutdowns: Not to be included with monitoring functions.

B. Rating

1. Voltage, phase and kW ratings as shown on Drawings.
2. kW rating established at .8 power factor.
3. Adjust alternator size as required to accommodate large-motor starting transients and/or harmonics if applicable.
4. Voltage regulation + 2%, no load to full load.
5. 125° C temperature rise at full load.

C. Instrumentation

1. Electronic control panel, including (but not limited) to the following digital indications:
    a. Oil pressure.
    b. Coolant temperature.
    c. AC voltmeter, ammeter, voltmeter/ammeter switch.

d. Running time meter.
e. Frequency meter. Electronic type. Vibrating reed and dial type not acceptable.
f. Integral start-stop engine controls.
g. 15 second crank with manual override.
h. NFPA 110 Level 1 safety indications.

2. Provide network interface module for web based access of all generator diagnostic information.

D. Remote Annunciator

1. Electronic control panel, including (but not limited) to the following digital indications:
   a. NFPA 110 Level 1 safety indications with separate LED for each item.
2. Visual and audible, with silence button on horn.
3. Include required remote manual emergency stop station. Note: It will be acceptable to have this station as a separate device located adjacent to the remote annunciator

E. Output Circuit Breaker

1. Refer to Section 262416 for approved circuit breaker types.
2. Integral mounting. Field mounting not acceptable.

F. Manufacturer: Caterpillar #D300 series; or equivalent by MTU #DS300 series.

2.2 SUB BASE FUEL TANK AND ACCESSORIES

A. General

1. Integral skid-mount type, with wiring accessibility for underground conduit runs.
2. Sized for minimum 24-hour full-load operation.
3. Integral low fuel and high fuel contacts for remote annunciation.
4. Double wall design with leak detection system.
5. Constructed and tested in accordance with UL 142.

B. Manufacturer: Klein, Tremont or equivalent by generator supplier.

2.3 MUFFLER

A. General

1. All welded construction.
2. Protected by high temperature, corrosion resistant coating.
3. Suitable for mounting in any position.
4. Rain cap, drip cap, and thimble.
5. Exhaust connector:
   a. Flexible.
   b. Stainless steel bellows type.
   c. 18" minimum length.
   d. Flanged connections for trade sizes 4" and larger.
   e. Drain plugs.

B. Size in accordance with manufacturer's recommendations, matched to specific engine use.

C. Rating: Critical.

D. Overall attenuation: 24 to 28 dBA.

E. Manufacturer: Riley Beaird, Inc., Maxim Silencer M41 series or equivalent by generator supplier.

2.4 STARTING BATTERIES

A. General

1. Industrial-grade lead acid.
2. Sized to provide three 15-second crank cycles.
3. Include battery tester, cables and clamps.
4. Tray conforming to NEC 480.8.
5. Battery heating pad.
    a. Manufacturer: Kim #KB series with #AL-S thermostat or equivalent by generator supplier.

2.5 BATTERY CHARGER

A. Cabinet

1. Wall-mount with NEMA 1 or 3R type enclosure as required by location.

B. Indicators

1. DC ammeter.
2. DC voltmeter.

C. Electrical Characteristics

1. Overload protection.
2. Silicon diode full wave rectifiers.
3. Voltage surge suppressor.
4. Fused AC input.
5. 120 volt single phase input + 10%.
6. Float range (Volts DC per cell @ 25° C): 2.15-2.19.
7. Equalize range (Volts DC per cell @ 25° C): 2.25-2.45.
8. Charger to automatically select equalize mode whenever normal power is restored. Automatically switches back to float mode when normal equalizing potential reached.
9. Capacity: Sized for specific batteries utilized, to prevent undercharging and overcharging.

D. Manufacturer: Master Control System #MBC6 series.

E. Other acceptable manufacturers: La Marche or equivalent by generator supplier.

2.6 PROTECTIVE HOUSING

A. Weather-resistant

1. The engine generator set shall be factory-enclosed in heavy gauge steel enclosure:
    a. Constructed with corner posts, coated with electrostatically applied zinc and finished with baked enamel paint (color as selected by Owner from standard color options).

b. With large easily opened doors to allow access to the engine, generator and control panel. Each door shall be fitted with stainless steel, lockable hardware, with identical keys. padlocks do not meet this Specification.
c. Mounted on the generator frame and shall include 2" Aeroflex or equivalent insulation with motor-operated intake and pressure exhaust damper (dampers shall be located on opposite ends of the enclosure). Motor-operated dampers shall be spring operated to open and motor closed.
d. With snow hoods or internal louvers (intake and exhaust).
e. Muffler shall be integral to enclosure (not mounted on top of enclosure). Rain cap included. Attenuation as required to meet overall requirements.
f. Package shall be pre-wired. All block heaters, battery chargers, unit heaters, etc. shall be wired by the manufacturer, facilitating a single point connection to a load center or fused terminal strip in the field.
g. With vermin proofing.
h. Sound levels shall be between 63-70 dBA with full load at 7 meters.

2.7 FUEL POLISHER

A. Compact packaged apparatus including programmable controller, replaceable 3 micron water block filter, magnetic conditioner, and pump.

B. Capable of polishing up to 640 gallons of fuel in 8 hours, 1.3 GPM flow rate.

C. AXI International #FPS-DX-S or approved equal.

D. Fuel polisher shall be factory installed/wired/plumbed inside the Generator Protective Housing.

2.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: One for each type and rating used.
2. Indicator Lamps: Two for each type used.
3. Filters: Three additional sets of each fuel, oil, and air filter elements required for the engine.
4. Fuel Polisher: Three additional water block filters and water block strainer baskets.

PART 3 – EXECUTION

3.1 STORAGE

A. Store generator in a cool, dry space prior to installation.

3.2 INSTALLATION

A. Install generator in accordance with Code, product listing and manufacturer's recommendations.

B. Provide Electrical Circuitry/Connections.

1. Generator Power.
2. Generator Engine Start Accessories.
   a. Batteries.

b. Battery Charger: 20/1 circuit breaker.
c. Battery heating pad: Same circuit as battery charger.
d. Ignition.

3. Generator Engine Heaters
   a. Water jacket heater: 20/1 or 30/2 circuit breaker as required.
4. Fuel System.
   a. Tank float switch.
   b. Solenoid valve - DC from engine.
5. Remote Annunciator
   a. Generator.
   b. Tank float switch.
   c. Rupture alarm float switch.

C. Provide network cabling in accordance with Division 27.

1. Provide one cable, category type as required by Section 271500, from nearest data rack patch panel to generator. Provide conduit for cable for any exterior locations, or in exposed ceiling areas, to nearest cable tray. Cable may extend in cable try to data rack. If no cable tray is available, extend cable above accessible ceiling spaces with proper supports as per Section 271500. Where any portion of cable is installed in conduit below grade, provide water-blocked cable.

D. Concrete Pad

1. Locate generator on concrete pad.
2. Dimensions: 8" high and extend minimum 8" from all sides of frame.
3. Verify and maintain required clearances as per manufacturer's recommendations.
4. Provided by Division 26. Coordinate installation.

E. Mount remote annunciator panel where indicated on Drawings. Provide raceway system and conductors as required.

3.3 START-UP AND TESTING

A. Supplier of generator shall provide the services of a factory-trained technician at start-up and testing of the installation.

B. Notify owner, engineer, and local fire Marshall or Fire Chief one week in advance of scheduled testing. Division 26 Contractor responsible for test coordination and scheduling.

C. A fuel allowance of $2,000.00 for onsite setup and initial testing shall be included in the bid. Fuel allowance shall be used to fill tank to maximum amount possible for allowance amount. Supplier shall use any remaining fuel allowance to refill tank after testing. Supplier shall provide actual fuel receipts with test reports to verify fuel amount filled. Any allowance amount remaining after testing refill is completed shall be credited back to the Owner via change order.

D. Factory-trained technician to perform tests as required and adjustments as needed. Tests shall include, but not be limited to:

1. Phase Rotation Test (phase rotation to match normal power).
2. Function test of all engine shutdown features such as low oil pressure, over-temperature, over-speed.

3. Vibration test.
4. Measure system charging voltage and individual cell voltages.
5. Measure electrolyte specific gravity and level.
6. Resistance load bank test:
    a. Stepped sequence, no load to full load, timed for proper engine "break-in" to ensure proper ring seating.
    b. Dry-type bank.
    c. Two hours under full load.
    d. Perform at project site.
    e. Provide written report for Record Manuals.
7. Automatic transfer switch operation and adjustment.

E. Furnish letter of verification to Engineer indicating that the generator system has been tested by the manufacturer's factory-trained technician and is found to be complete and functional. List date of testing, name of factory-trained technician, and names of any other persons in attendance.

3.4 INSTRUCTIONS

A. The generator supplier factory-trained technician shall instruct the Owner in proper operation, maintenance and testing of the complete generator system. Indicate on letter of verification, name of Owner's representative receiving instructions.

B. Record instructions and include with Record Manuals in accordance with Section 260500.

3.5 WARRANTY

A. Warranty shall be for a period of two years from date of project substantial completion, and shall include defective parts, workmanship, labor, mileage and travel time. Running hours shall not be limiting factor.

B. Provide written warranty agreement

3.6 MAINTENANCE SERVICE

A. At substantial completion, begin 24 months full maintenance servicing by skilled employees of the manufacturer's designated service organization. Include quarterly exercising to check for proper starting, load transfer, and running under load. Include routine preventative maintenance as recommended by the manufacturer and adjusting as required for proper operation. Maintenance service shall include parts and supplies as used in the manufacture and installation of the original equipment along with all required labor, mileage, and travel time.

B. Provide written maintenance agreement.

END OF SECTION

SECTION 26 3600 – TRANSFER SWITCHES

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Provide transfer switch for standby power system, in accordance with NFPA 110 Level 1, as shown on Drawings, and specified herein.

B. Description of System

1. Automatic transfer switch to stop and start emergency generator and transfer load from normal to emergency source.
2. Manual transfer switch to transfer load from normal to emergency source.

1.2 QUALITY ASSURANCE

A. UL Standard 1008.

B. To ensure coordinated equipment operation and performance, and to centralize responsibility, equipment covered by this Section shall be furnished and warranted by the same supplier as the emergency generator.

1.3 SUBMITTALS

A. Shop Drawings

1. Submit information in accordance with Section 260500.
2. Include:
   a. Amperage.
   b. Voltage.
   c. Phase pole quantity and neutral configuration.
   d. Dimensions.
   e. Installed weight.
   f. Electrical connections.
   g. Time delays.
   h. Enclosure type.
   i. Short circuit withstand rating.
   j. Any other pertinent information.

B. Record Manuals

1. Submit information in accordance with Section 260500.

a. Include fault current available at each set of lug terminals. Fault current calculations shall be based on actual installation criteria (conductor lengths, raceway types, etc.). Provide separate calculation from normal power source and alternate power source; indicate calculated values for each.

2. Include manufacturer's instructions for maintaining and operating the transfer switch, including repair parts list, adjusting time delay relays, troubleshooting guide, wiring schematics and etc.
3. Provide multiple copies: One to remain with transfer switch, other copies for Record Manuals.

PART 2 – PRODUCTS

2.1 AUTOMATIC TRANSFER SWITCH

A. Ampere rating, voltage rating and phase pole quantity as indicated on the Drawings or as required by generator full load ampere rating.

B. Use rating shown on standard specification sheet. Special ratings not acceptable.

C. Mechanically held with open transition.

D. Solid neutral.

E. Time Delays

1. NFPA 110 Level 1.
2. Engine starting, adjustable .5 to 6 seconds. Factory set at one second.
3. Transfer to emergency after emergency source attains 90% of rated voltage and 95% of rated frequency, adjustable 0 to 5 seconds. Factory set at .5 seconds.
4. Retransfer to normal, adjustable 0 to 30 minutes. Delay automatically bypassed if emergency source fails and normal source is available. Factory set at 20 minutes.
5. Engine cool down, adjustable 0 to 5 minutes. Factory set at 5 minutes.

F. Test switch to momentarily simulate normal source failure.

G. Auxiliary contacts, two NO-NC rated 10 amps, 480 V 60 Hz.

H. Source identification signal lights.

I. Microprocessor Controller:

1. Undervoltage, overvoltage, underfrequency, overfrequency and voltage unbalance monitoring of both normal and emergency sources.
2. Adjustable dropout and pickup set points for all five situations.
3. Phase monitoring to control inrush currents at transfer.
4. Generator exercising to be 7-day programmable with selectable “load” or “no load” testing.
5. LCD display with keypad for menu driven control of set points, time delays and generator exerciser functions.
6. Real time clock with battery backup.
7. Include Ethernet communication module for network interface capabilities. Allows web based access to all parameters available at HMI.

J. Provide power manager module to monitor/report electrical characteristics.

1. Voltage per phase, neutral, and unbalance.
2. Current per phase, neutral, and unbalance.
3. Real, Apparent, and Reactive power per phase and total.
4. Power Factor.
5. Frequency.
6. Accumulated Energy.

K. Manufacturer: ASCO 7000 series.

L. Other acceptable manufacturers: Approved equal units by Russelectric Inc. (RMT series).

2.2 REMOTE ANNUNCIATOR

A. Graphical touch-screen.
   1. ATS reporting/monitoring with alarm annunciation.
   2. NFPA 110 generator annunciation.
   3. Generator real time performance dashboard.
      a. Including but not limited to engine speed, oil pressure, coolant temp, and fuel level.

B. Web based with remote access capability.

C. Alarm reporting via email/text.

D. Manufacturer: ACSO 5705 series.

2.3 MANUAL TRANSFER SWITCH

A. Voltage, phase and ampere rating as shown on the drawings.

B. Manufacturer: Same as panelboard manufacturer.

PART 3 – EXECUTION

3.1 STORAGE

A. Store transfer switch in a cool, dry area prior to installation.

3.2 INSTALLATION

A. Install transfer switch in accordance with Code, product listing, and manufacturer's recommendations.

B. Securely mount transfer switch and accessories where shown on Drawings.

C. Provide all control and power wiring/connections.

D. Provide network cabling in accordance with Division 27.

   1. Provide one cable, category type as required by Section 271500, from nearest data rack patch panel to transfer switch. Provide conduit for cable for any exterior locations, or in exposed ceiling areas, to nearest cable tray. Cable may extend in cable try to data rack. If no cable tray is available, extend cable above accessible ceiling spaces with proper supports as per Section

271500. Where any portion of cable is installed in conduit below grade, provide water-blocked cable.

E. Concrete Pad

1. Locate ATS on concrete pad.
2. Verify and maintain required clearances as per manufacturer's recommendations.
3. Provided by Division 26. Coordinate installation.

3.3 TESTS

A. Test in conjunction with generator.

3.4 INSTRUCTIONS

A. Manufacturer's representative shall instruct Owner in proper operation, maintenance and testing of complete transfer switch system. Representative shall assist the Owner in programming an exercise schedule that meets NFPA 110 Level 1 requirements. Indicate on Section 263213 letter of verification, name of Owner's representative receiving instructions.

B. Record instructions and include with Record Manuals in accordance with Section 260500.

3.5 CLEANING

A. **Clean** and **vacuum interior** to remove all wire and insulation scraps, dust and dirt.

B. Clean all exposed surfaces immediately prior to final inspection.

END OF SECTION

SECTION 26 4313 – SURGE PROTECTIVE DEVICES

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Provide integral Surge Protective Device in panelboards and switchboards where indicated and scheduled.

1.2 SUBMITTALS

A. Shop Drawings

1. Submit information in accordance with Section 260500.

B. Record Manuals

1. Submit information in accordance with Section 260500.
2. Include installation and maintenance instructions accompanying equipment.

PART 2 – PRODUCTS

2.1 TYPE 2 SURGE PROTECTIVE DEVICE (SPD)

A. Provided only in panelboards and switchboards as indicated on the drawings.

B. The panelboard/switchboard manufacturer shall internally install SPD protection within the panelboard and the entire assembly shall be UL 67 listed.

C. SPD requirements:

1. Listed and component recognized in accordance with latest editions of UL 1449, UL 96A and UL 1283.
2. Minimum surge capacity ratings as indicated on the drawings. Operating voltage and configuration as indicated on the drawings
3. 200kA Short Circuit Current Rating (SCCR). SPD devices obtaining SCCRs using upstream over current protection are prohibited.
4. 20kA nominal discharge current.
5. EMI/RFI noise filtering attenuation up to 50dB for 10kHz – 100MHz.
6. Self contained module design, with each suppression element metal-oxide varistor (MOV) based incorporating thermal protection. End of life mode shall be open circuit.
7. Surge current diversion paths between each phase conductor and the neutral conductor, between each phase conductor and the ground and between the neutral conductor and ground. For delta configured systems, the SPD shall have components connected between each phase conductor and between each phase conductor and ground.

8. UL 1449 latest edition listed and recognized component voltage protection rating (VPR) shall not exceed:

VOLTAGE	L-N	L-G	N-G	L-L
240/120 1Ø	700V	700V	700V	1200V
208Y/120	700V	700V	700V	1200V
240D/120	700/1200V	700/1200V	700V	1800V
480Y/277	1200V	1200V	1200V	2000V

9. Designed to withstand a maximum continuous operating voltage (MCOV) of not less than 115% of nominal RMS voltage.
10. Equipped with on board visual and audible diagnostic monitoring devices mounted on the front cover of the SPD.
    a. Indicating lights shall provide full time visual diagnostic monitoring of the operational status of each phase of the surge current diversion module.
    b. Audible diagnostic monitoring shall be by way of audible alarm. This alarm shall activate upon a fault condition. An alarm on/off switch shall be provided to silence the alarm.
    c. LCD display surge counter located on the front cover of the SPD. Counter shall be equipped with a manual reset with protection from accidental operation and utilize non-volatile memory.
    d. A set of Form "C" dry contacts shall be provided for remote annunciation.
11. Warranty: The panelboard manufacturer shall warranty the SPD for full replacement if destroyed by transients, including lightning, for a period of ten (10) years.

PART 3 – EXECUTION

3.1 INSTALLATION

A. SPD protection modules shall be factory installed by the panelboard/switchboard manufacturer integral to the panelboards/switchboards indicated on the drawings. Each entire assembly shall be UL 67 listed.

3.2 TESTS

A. Verify all SPD equipment is active and in proper working condition prior to final project inspection.

3.3 CLEANING

A. **Clean** and **vacuum interior** to remove all wire and insulation scraps, dust and dirt.

B. Clean all exposed surfaces immediately prior to final inspection.

END OF SECTION

SECTION 26 5100 - LUMINAIRES

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Furnish and install a complete luminaire for each lighting outlet.

1.2 SUBMITTALS

A. Shop Drawings

1. Submit information in accordance with Section 260500 including voltage, housing and door frame material, lens type, diffuser thickness, lumen output, and color temperature.

B. Record Manuals

1. Provide information in accordance with Section 260500.

1.3 COORDINATION

A. Confirm compatibility and interface of luminaire with other materials and job conditions prior to ordering. Report discrepancies to Engineer and defer ordering until clarified.

B. Provide frames, trim rings, and backboxes as required.

C. Coordinate with work of all other Divisions to avoid conflicts between luminaires, supports, fittings and mechanical equipment. Ceiling clearances are minimal. It is imperative that Contractors coordinate conduit and duct runs to facilitate luminaire installation as shown on reflected ceiling plans. Engineer will not be responsible for interferences arising from lack of field coordination between trades.

PART 2 – PRODUCTS

2.1 LUMINAIRES

A. General

1. UL or other NRTL listed.
2. Where shown to be installed in fire-rated assemblies, luminaires shall be listed in accordance with UL Standard 1598. Supplemental penetration protection (tenting) will be accomplished by General Contractor in accordance with UL Fire Resistance Directory. Coordinate installation with General Contractor. Supplemental protection shall be spaced minimum 1/2" away from the luminaire, per UL Standard 1598.
3. Verify ceiling finishes and equip all recessed luminaires with appropriate frames as required.
4. Furnish luminaires intended for use in lay-in grid ceilings with proper clips for compliance with NEC.
5. Refer to Section 260500 for "Prior Approval to Quote" procedure.

B. LED Lighting Systems

1. General: All LED lighting system components must be UL or other NRTL listed.
2. Light Engines:
   a. Meets or exceeds 70% lumen maintenance at 50,000 hours based on IESNA LM-79-2008.
   b. Minimum 80+ CRI rating.
   c. 4000K color temperature, or as scheduled on drawings.
   d. Minimum delivered lumens as scheduled on drawings.
3. Electronic drivers for LED's:
   a. Factory installed.
   b. Multi-volt for use on either 120v or 277v systems.
   c. THD: < 20%.
   d. Factory installed quick-disconnect plug internal to the luminaire for driver removal.
   e. Rated for a minimum of 50,000 hours.
   f. 0-10 Volt dimming standard. Provide non-dimming drivers only as scheduled.
      1) Controls and wiring as per manufacturer's recommendations. Provide power packs for wall-box dimmers as required for positive luminaire off.
4. Downlights shall incorporate integral diffuser type lens. Exposed modules not acceptable.
5. Emergency battery packs:
   a. Include self-testing/self-diagnostics with audible alarm option.
   b. Factory installed.
   c. Minimum lumens as scheduled.
6. Spare Drivers:
   a. Luminaire manufacturer shall keep reasonable driver stocks on hand for replacement of defective drivers under guarantee period.
7. Guarantee period: Minimum 60 months from date of substantial project completion.
   a. Guarantee shall include all parts and labor required to bring luminaire to complete operation.
   b. Labor shall be performed by an Owner approved Electrical Contractor licensed in the area the work is to be performed.
   c. Any costs for equipment rentals required to service luminaires under warranty shall be the responsibility of luminaire manufacturer.

PART 3 – EXECUTION

3.1 STORAGE

A. Store luminaires in a cool, dry space prior to installation.

3.2 INSTALLATION

A. General

1. Install luminaires plumb and true, free of light leaks, warps, dents and other irregularities.
2. Equip any outlets not specifically labeled with a luminaire the same as those in rooms used for similar purposes.
3. Run all directional lenses the same direction in rooms, corridors and other adjacent areas that contain square luminaires.
4. Continuous row luminaires: Hang level in straight line and butt tightly together.

5. Verify exact location of luminaires with reflected ceiling plan. Any discrepancies between the lighting plan, reflected ceiling plan, or installed ceilings shall be brought to the attention of the Engineer for clarification prior to installation.
6. Coordinate with Mechanical Contractor in advance of installation to prevent space conflicts.
7. Connect recessed luminaires to branch circuitry by means of single flexible metal conduit 6'-0" in length.

B. Barriers

1. Required where recessed luminaires are installed in insulated ceilings.
2. Suitable material to satisfy NRTL requirements.
3. Provided by Division 26 when not indicated otherwise.
4. Coordinate installation.

C. Luminaire Supports

1. Provide adequate supports to any structures, ceilings and grid systems to safely suspend or attach luminaires.
2. General Contractor to provide ceiling support systems as required by that portion of the Specifications. Electrical Contractor to provide any additional supports on an "as needed" basis to prevent ceiling from sagging or developing other irregularities.
3. Contractor responsible for providing proper suspension and mounting devices and to safely support all luminaires shown on Drawings, regardless of ceiling systems.
4. Rigidly support surface suspended ceiling system with anchors, hangers or clips designed for the purpose.
5. Support surface-mounted luminaires at four-foot intervals.
6. Install recessed luminaires in accordance with manufacturer's recommendations.
7. Rigidly support recessed luminaires to structural members or properly supported ceiling system with hangers, clips or fasteners designed for the purpose.
8. Support pendant and stem-hung luminaires at four-foot intervals.

D. 0 – 10 Volt Dimming Control Circuits

1. Installed in accordance with NEC Article 725.
2. Class 1 systems
    a. #14 AWG THWN/THHN solid conductors installed in the same raceway as associated power wiring.
3. Class 2 systems
    a. #18/2 non-shielded cable unless otherwise indicated on the drawings.
    b. Plenum rated where required.
    c. Cable shall be installed in raceway when concealed within walls, in mechanical rooms, and rooms without ceilings.
        1) DO NOT INSTALL IN SAME RACEWAY AS POWER CIRCUITRY.
    d. Cable not required to be enclosed in raceway when installed above accessible ceilings.
        1) Route cables parallel or perpendicular to building construction.
        2) Support cables from building structure utilizing approved methods.
        3) Neatly coil excess cable length of pre-terminated assemblies.
        4) All cable runs shall be continuous between devices. NO SPLICING.

3.3 TESTS

A. Upon completion of this portion of the Work and prior to its acceptance by Owner, check for proper alignment and operation of all lighting equipment.

3.4 CLEAN UP

A. Clean all luminaires immediately prior to final inspection.

END OF SECTION

SECTION 26 6510 – OVERHEAD DOOR WIRING

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Provide all wiring and control equipment not furnished with overhead door, for complete and satisfactory operation.

B. Overhead door wiring includes:

1. Power connections.
2. Control station installation.
3. Control connections between limit switches, safety devices, and door operator.

C. Work Not Included

1. Refer to overhead door section of specification for extent of material furnished with door.

PART 2 – PRODUCTS

2.1 MATERIAL

A. Disconnect Switches

1. Refer to Section 262816.
2. Separate switches required for each door.
3. Toggle switches acceptable for 115 volt rated motors.

B. Outlet Boxes

1. Refer to Section 260534.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install controller, push-button or key-operated stations for each overhead door. Provide conduit, boxes and wiring material required for electrical connection, including control cable connection to limit switches and safety devices.

B. Where used, locate key-operated control stations on exterior of building, flush mounted. Seal conduit after conductor installation.

END OF SECTION

SECTION 27 0500 – DIVISION 27 GENERAL PROVISIONS

PART 1 – GENERAL

1.1 DESCRIPTION

A. The provisions and requirements of Section 260500 shall be applicable to Division 27.

B. All Division 27 work shall be included under the Division 26 contract.

C. The Contractor shall take special note that any conflicts between the Contractor and any Division 27 subcontractors shall not become an issue of the Engineer or Owner. It shall be the Contractor's responsibility to coordinate with the Division 27 subcontractor/s to determine where their work leaves off and where the subcontractor's work begins. The Contractor shall be responsible for all specified work including the operations of work under Division 27.

END OF SECTION

SECTION 27 0528 – NETWORK SYSTEMS ROUGH-IN

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Provide raceways for network systems as shown on the Drawings.

B. Work furnished and installed by others.

1. Local serving telephone utility shall place the service entrance cable to the point of presence, install circuit protection cabinet, protectors, and ground the entrance cable as needed to the service grounding conductor provided under this contract.
2. Owner's network systems supplier shall provide all network cables, devices, faceplates, terminations, data racks, end-user software, programming, computer servers, terminals and personal computers.

PART 2 – PRODUCTS

2.1 GENERAL

A. Main telephone terminal boards (TTB): ¾" grade AD fire-resistant plywood, painted gray (including edges). Dimensions as required by serving utility company.

B. Voice/data terminal board (TTB):

1. ¾" grade AD fire-resistant plywood, painted gray (including edges). Dimension as required by Owner's network system supplier. May be included with main telephone terminal board for single board installation.

C. Raceways:

1. As specified in Section 260533 and sized as shown on Drawings, minimum 3/4".

D. Boxes:

1. 2-1/8" deep unless restricted by wall thickness.
2. As specified in Section 260534 and 260540.

E. Blank plates:

1. As specified in Section 262726, yoke-mounted. Box-mounted plates not acceptable.

F. Firestop Assemblies

1. NRTL listed 4" square pathway with intumescent material designed to seal out fire, smoke, and toxic gases.

2. Quantity shall equal or exceed the width of the associated cable tray. i.e. a 6" wide tray requires two pathways.
3. Include mounting accessories as required by application specifics.
4. Manufacturer: EZ Path Series 44, 3M Model PT4SD or approved equal.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Serving Communications Utility Requirements

1. Raceways:
   a. Provide telephone service entrance conduit, stubbed to terminal board from property line.
   b. Verify service entrance conduit size and quantity, and property line location with serving utility.
   c. Provide bushing or connector at each conduit stub.
   d. Provide pull wire in each telephone conduit run.
2. Provide surface double-duplex receptacle at main telephone terminal board, fed from dedicated spare circuit breaker. Receptacles to be isolated ground type, with separate grounding conductor connected to panelboard grounding bar.
3. Provide telephone board communication grounding bus as required by serving utility, minimum #6 solid SDBC in conduit, extended shortest and most direct route to ground bar at main switch. Terminate in ground bar affixed to telephone terminal board, location as directed by serving utility.
4. Entire installation to comply with serving utility company requirements.

B. Raceways:

1. Stub from rough-in location to within 6" of nearest cable tray, or location as indicated on drawings.
2. Provide bushing or connector at each conduit stub.
3. Provide pull wire in each voice/data raceway.
4. Provide raceway system where concealed in walls, in mechanical rooms and rooms without accessible ceilings.

C. Provide blank plates for all rough-in boxes not concealed by Owner's voice/data equipment.

D. Entire installation to comply with Owner's network systems supplier requirements.

END OF SECTION

SECTION 27 1513 – NETWORK CABLING

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Provide Network Cabling System as shown and described.

B. Work furnished and installed by others.

1. Voice: The Owner will provide all telephone handsets.
2. Data: The Owner will provide all end-user software, programming, computer servers, terminals and personal computers.
3. Surveillance: The surveillance system cameras, servers, switches and storage equipment will be provided and installed either by the Owner or under other Sections of this specification.

C. Description of System

1. Voice: Work shall include, but not be limited to, devices, faceplates, cables and cable assemblies, connecting blocks, cable management, terminations, and final acceptance testing.
2. Data: Work shall include, but not be limited to, devices, faceplates, cables and cable assemblies, cable management, patch panels, data racks, terminations, and testing.
3. Surveillance: Work shall include, but not be limited to, devices, cables and cable assemblies, cable management, patch panels, data racks, terminations, and testing.

1.2 SUBMITTALS

A. Shop Drawings

1. Submit information in accordance with Section 260500.
2. Indicate:
   a. Mounting details.
   b. Connection diagrams.
   c. Description of devices.
   d. Name of installation Contractor/Subcontractor.

B. Record Manuals

1. Provide information in accordance with Section 260500.
2. Include manufacturer's data for adjustment, operation and maintenance of equipment and name of service organization.

PART 2 – PRODUCTS

2.1 MANUFACTURER/SUPPLIER

A. The system specified is based on equipment as manufactured by General Cable, Panduit, Commscope and other manufacturers as listed. All reference to model numbers and other pertinent information is intended to establish the standards of operational concepts, performance, quality and appearance which must be met. Backboards, conduit, cable tray, and rough-ins shall be by Electrical Contractor.

B. Contractors/Subcontractors performing Section 271500 work shall have personnel trained/certified in communications cabling installation via equipment manufacturers' or industry standards' training programs. Refer to Section 260500-1.5 Quality Assurance.

C. Acceptable installers:

1. Computer Store, 1100 S Broadway, Minot, ND 58701, 701/838-3967.
2. Data Connections, 4016 37th Avenue NW, Mandan, ND 701/426-8771.
3. Dell-Comm, Inc. 812 S 18th St., Bismarck, ND 58504, 701/222-2887.
4. Gefroh Electric, 100 45th Ave NW, Minot, ND 58703, 701/838-0225.
5. Innova Integrated Systems, 1800 22nd Ave SW, Minot, ND, 701/837-0131.
6. Main Electric, 2626 Valley St., Minot, ND 58701, 701/852-3315.
7. Maycomm, 1711 12th Ave SW, Minot, ND 58701, 701/838-8401.
8. Muth Technology, 600 E Benson Rd, Sioux Falls, SD 57104, 800/888-1597.
9. RBB Electric, 1123 N 1st St., Grand Forks, ND 58208, 701/775-7404.
10. Wheeler Construction, 1720 South Broadway, Minot, ND, 58701, 701/852-5584.
11. Installers not listed above and wishing to quote shall refer to Specification 260500-1.4 for approval procedure. No consideration shall be given to any installer not pre-approved.

2.2 DEVICES AND FACEPLATES

A. Data jacks: Single outlet RJ45, eight-pin/eight wire, modular construction, TIA/EIA-568.2-D Category 6 compliant, T568A and T568B identification, Panduit Mini-Com #CJ688TG, Commscope #MGS400 series, Leviton #61UJK series, or approved equal.

B. Voice jacks: Same as data jacks.

C. Voice wall-mount face plate/jack assembly: Stainless steel with Category 6 keystone jack, Panduit #KWP6, Commscope #630B8, Leviton #4108W1SP series, or approved equal.

D. Faceplates

1. Single gang with ID windows and two or four modular inserts as dictated by jack count shown on the drawings.
2. 430 or 302/304 stainless steel, or as selected by Architect.
   a. Panduit #CFPL2/4 series, Commscope #M12/14SP-L series, Leviton #43080-1L2/4 series, or approved equal.
3. Where plastic plates are selected by Architect.
   a. Panduit #CFPE2/4 series, Commscope #M12/14L series, Leviton #42080-2/4 series, or approved equal.

E. Provide blank modules as required. Panduit #CMB, Commscope #M81, Leviton #41084 series, or approved equal.

F. Color: Devices as selected by Owner, faceplates as selected by Architect.

G. Surveillance Cameras

1. Jack assembly for cameras mounted to accessible ceilings shall utilize Panduit Model #CBXQ1IW-A enclosure mounted to building structure above the ceiling. Surveillance system provider shall be responsible for patchcord between camera and jack.

2. Cameras mounted directly to rough-ins or surface boxes shall utilize cable terminated to RJ45 Plug, Panduit Model #FP6X88MTG field terminating type or approved equal. Provide minimum 12" extra cable length within rough-in or camera mounting equipment.

2.3 CABLES AND CABLE ASSEMBLIES

A. Station cables (voice and data): Four unshielded, twisted pair, #23 gauge, Category 6 – 350 MHz, solid copper conductor, cable tray and plenum rated.

1. General Cable #7131900, Commscope #2088B, Berk-Tek #10032094 or equivalent meeting the following characteristics at 250 MHz.
   a. ACR: 10.5 dB min. @ 100m
   b. PS-ACR: 8.5 dB min. @ 100m
   c. ELFEXT: 24.5 dB min.
   d. PS-ELFEXT: 21.5 dB min.
   e. NEXT: 43 dB min.
   f. PS-NEXT: 41 dB min.
   g. ATTEN.: 32.8 dB max. @ 100m
   h. LCL: 26 dB min.
   i. Return Loss: 20 dB min.

B. Extended Range cable: Four unshielded, twisted pair, #22 gauge, Category 6, solid copper conductor, cable tray and plenum rated.

1. Limited power listed for up to 90 Watts (PoE Type 4)
2. Certified for 10 Mbps transmission up to 250 meters.
3. Certified for 1 Gbps transmission up to 200 meters.
4. General Cable #8131800, Paige #258300336, or equivalent meeting the following characteristics at 250 MHz.
   a. Insertion Loss: 30.6 dB/100m max.
   b. Return Loss : 17.3 dB/100m min.
   c. NEXT: 38.3 dB/100m min.
   d. PSNEXT: 36.3 dB/100m min.

5. Use only where indicated on the Drawings.

C. Outside Plant cable: Four unshielded, twisted pair, #23 guage, Category 6, solid copper conductor, gel filled water block for underground/wet applications and UV resistant insulation.

1. General Cable #7136100, Commscope #1572A, Berk-Tek #10139885 or equivalent meeting the following characteristics at 250MHz.

a. Insertion Loss: 32.8 dB max.
b. Return Loss : 17.3 dB min.
c. NEXT: 38.3 dB min.
d. PSNEXT: 36.3 dB min.

D. Outside Plant Extended Range cable: Four unshielded, twisted pair, #22 gauge, Category 6, solid copper conductor, gel filled water block, wet listed, and extended range.

1. Limited power listed for up to 90 Watts (PoE Type 4)
2. Certified for 10 Mbps transmission up to 250 meters.
3. Certified for 1 Gbps transmission up to 200 meters.
4. General Cable #8146100, Paige #258330804, or equivalent meeting the following characteristics at 250 MHz.
   a. Insertion Loss: 30.6 dB/100m max.
   b. Return Loss : 17.3. dB/100m min.
   c. NEXT: 38.3 dB/100m min.
   d. PSNEXT: 36.3 dB/100m min.

2.4 WIRELESS ACCESS POINT (WAP) CABLING

A. Cabling for WAP's shall be Limited Power Listed CAT 6A.

1. Data jacks: Single outlet RJ45, eight-pin/eight wire, modular construction, TIA/EIA-568.2-D Category 6A compliant, T568A and T568B identification, Panduit Mini-Com #CJ6X88TG, or approved equal.
2. Above Ceiling Installation: Panduit #CBXQ2IW-A, or Approved Equal surface termination box attached to building structure.
3. Station cables: Four unshielded, twisted pair, #23 gauge, Category 6A – 500 MHz, solid copper conductor, cable tray and plenum rated. UL Listed CMP-LP (0.7A).
   a. General Cable #7151850 or Approved Equal meeting the following characteristics per 100 meters at 500 MHz.

      1) ACRF: 13.8 dB min.
      2) PSACRF: 10.8 dB min.
      3) PSAACRF: 32.0 dB min.
      4) NEXT: 33.8 dB min.
      5) PSNEXT: 31.8 dB min.
      6) PSANEXT: 60.0 dB min.
      7) Return Loss: 15.2 dB min.

2.5 MISCELLANEOUS PRODUCTS

A. Cable management:

1. 6" die-cast aluminum distribution rings: Allen Tel #GB13C or equivalent.
2. Plenum velcro cable ties: Panduit #HLSP series or equivalent.
3. Cable hooks with retainers: B-Line #BCH series or equivalent.

B. Patch Panels

1. Patch panels shall have modular jack-style termination connectors, be 24-port or 48-port in size, one or two standard EIA rack spaces in height. The panels shall have separate port and panel designation strips. Panduit #CP24BL or #CP48BL, Commscope #M2400-1U-GS, Leviton #49255-H24 or #49255-H48, or approved equal.
2. Quantity: As required by station cable count.

C. Data Rack (DTR)

1. 84", floor-mounted, EIA/TIA 19" rack assembly. Panduit #R2P, Hoffman #EDR19FM45U, Chatsworth #55053-X03, or equivalent, quantity as shown on Drawings.
2. Provide horizontal cable management panels with integral bend radius control for front and rear cables. Size and quantity determined by cable and patch panel quantity. Panduit #NCMH2, Hoffman #DCHD2, Chatsworth #13930-702, or equivalent.
3. Provide full height 4"x5" vertical cable management panels for front and rear cables. Panels required on both sides of rack. Panduit #WMPV45E, Hoffman #DV6D7, Chatsworth #13915-703, or equivalent.

D. Identification:

1. Panduit #LS8E or Pan-Mark labeling systems or equivalent. Hand lettering not acceptable.

E. Power Strip:

1. 19" rack-mounted surge suppression strip. Six (6) NEMA 5-20 duplex receptacles. UL1449 listed. Clamping level not to exceed 330 volts.
2. Manufacturer: Leviton #5500-192 or equivalent.
3. Quantity: One per data rack.

2.6 COLOR

A. All cables shall match their associated jack color for type of system served unless otherwise indicated.

B. Verify cable and jack color configuration with Engineer/Owner's Rep.

C. Typical color configuration.

1. Voice Jacks – Match Faceplate (Yellow cable)
2. Data Jacks – Yellow
3. WAP – Orange
4. Cameras – Purple

PART 3 – EXECUTION

3.1 STORAGE

A. Store system equipment in cool, dry space prior to installation.

3.2 GENERAL

A. Securely install components where shown on Drawings.

B. Contractor shall adjust and provide all other assistance required at final inspection to bring the system satisfactorily on-line.

C. Install in accordance with NEC, EIA/TIA Standards, NRTL listing, and manufacturer's recommendations and instructions.

D. All cables that extend underground shall be listed for use in wet locations. See Outside Plant cables in Part 2 for requirements.

E. Cable:

1. Install cables in raceways as required by Section 270528 and in cable tray (communications type) where cable tray is specified.
2. Route open air cables (where not in raceway or cable tray) parallel or perpendicular to building construction supporting with specified products, maximum 4'-0" on center.
3. Bundle multiple open air cable runs located in TTB/TB rooms together with velcro cable ties
4. Identify ends of cables with room designations as directed by Owner.
5. Bending radius shall be minimum 1".
6. All cable runs shall be continuous, **NO SPLICING**.

3.3 DATA

A. Provide Data Rack(s) as shown and specified.

B. Install patch panels and cable management system in Data Rack.

C. Install data station cable from patch panel to data outlet locations as shown on the Drawings. Cable length not to exceed 295 feet.

D. Terminate cables according to T568A or T568B wiring scheme as determined by Owner's system requirements.

E. Extended range cable to only be used where indicated on the Drawings, or where approved by the Engineer. Use of this cable is not permitted as an alternative to change or alter network system distribution locations or quantities.

F. Identify cable at both ends according to Owner's convention. Arrange patch panels and patch panel jacks as per Owner's convention. Identify all patch panels, patch panel jacks, and faceplate jacks according to Owner's convention.

1. If no convention is available, room numbers shall be incorporated into the identification. Ex: For room 120, use 120-1 for first cable, 120-2 for second cable, etc.

3.4 SURVEILLANCE

A. Install separate dedicated patch panels in Data Rack for the camera cables.

B. Install station cable from patch panel to camera locations as shown on the Drawings. Cable length not to exceed 295 feet. Verify exact camera location and mounting configuration with Surveillance System installer.

1. Extended range cable to only be used where indicated on the Drawings or where approved by the Engineer.

C. Terminate cables according to T568A or T568B wiring scheme as determined by Owner's system requirements.

D. Identify cable at both ends according to Owner's convention. Arrange patch panels and patch panel jacks as per Owner's convention. Identify all patch panels, patch panel jacks, and faceplate jacks according to Owner's convention.

1. If no convention is available, camera numbers shall be incorporated into the identification. Ex: For camera 21, use C-21.

3.5 GROUNDING

A. For each data rack, provide one #10 AWG solid copper conductor from data rack to nearest panelboard with equipment ground bus.

B. Where multiple data racks are located in single room (more than 2), provide isolated communication grounding bus in room. Extend #6 solid SDBC in conduit, extended shortest and most direct route to ground bar at nearest panelboard with equipment ground bus. Extend one #10 AWG solid copper conductor from each data rack to communication grounding bus in room.

3.6 TESTING REQUIREMENTS

A. All terminated voice and data cables shall be tested and certified for TIA/EIA-568.2-D. Category 6 standards. The test shall be performed on the permanent link configuration (from station jack to patch panel jack). These standards require the following when tested at 250 MHz:

1. Return Loss shall be no less than 10.0dB.
2. Insertion Loss (Attenuation) shall not exceed 31.1dB.
3. Near End Cross Talk (NEXT) shall be no less than 35.3dB.
4. Power Sum Near End Cross Talk (PSNEXT) shall be no less than 32.7dB.
5. Attenuation to Crosstalk Ratio Far-end (ACRF) shall be no less than 16.2dB.
6. Power Sum ACRF (PSACRF) shall be no less than 13.2dB.
7. Propagation Delay shall be less than 490 nanoseconds.
8. Propagation Delay Skew shall be less than 44 nanoseconds.

B. All terminated WAP cables shall be tested and certified for TIA/EIA-568.2-D. Category 6A standards. The test shall be performed on the permanent link configuration (from station jack to patch panel jack). These standards require the following when tested at 500 MHz:

1. Return Loss shall be no less than 8.0dB.
2. Insertion Loss (Attenuation) shall not exceed 43.8dB.
3. Near-end Cross Talk (NEXT) shall be no less than 26.7dB.
4. Power Sum Near-end Cross Talk (PSNEXT) shall be no less than 23.8dB.
5. Attenuation to Crosstalk Ratio Far-end (ACRF) shall be no less than 10.2dB.
6. Power Sum ACRF (PSACRF) shall be no less than 7.2 dB.
7. Propagation Delay shall be less than 490 nanoseconds.
8. Propagation Delay Skew shall be less than 44 nanoseconds.
9. Power Sum Alien Near-end Cross Talk (PSANEXT) shall be no less than 49.5 dB.
10. Power Sum Alien Attenuation to Crosstalk Ratio Far-end (PSAACRF) shall be no less than 23.7 dB.

C. Additional testing shall include line mapping and cable length before final acceptance by Owner.

1. DC resistance shall be less than 3% or less than 150 milli-Ohms.

D. All permanent link cable runs shall be documented with a hard copy print-out of the test results. Compile one copy of test results in a loose-leaf binder, similar to manual references in Section 260500, 1.04E. Submit at project completion with referenced Record Manual.

E. Field tester to be Level III and conform to TIA/EIA 568.2-D Annex A & B requirements.

3.7 CLEANING

A. **Clean** and **vacuum interior** to remove all wire and insulation scraps, dust and dirt.

B. Clean all exposed surfaces immediately prior to final inspection.

END OF SECTION

SECTION 27 1523 – FIBER OPTIC CABLING

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Provide Fiber Optic Cabling System as shown and described.

B. Work furnished and installed by others.

1. The Owner will provide all end-user software, programming, computer servers, hubs/switches, media converters, and personal computers.

C. Description of System

1. Fiber optic work shall include but not be limited to raceway installation, pulling of fiber optic cable, splicing and terminating of cable assemblies and final acceptance testing.

1.2 SUBMITTALS

A. Shop Drawings

1. Submit information in accordance with Section 260500.

B. Record Manuals

1. Provide information in accordance with Section 260500.

C. Record Drawings

1. Indicate exact locations of junction boxes containing cable for future connection.

PART 2 – PRODUCTS

2.1 MANUFACTURER/SUPPLIER

A. All reference to model numbers and other pertinent information is intended to establish the standards of operational concepts, performance, quality, and appearance that must be met.

B. Acceptable installers/suppliers:

1. Refer to Specification Section 271513, 2.1B&C.

2.2 FIBER OPTIC RACEWAY

A. Corrugated, non-metallic, flexible raceway for use in plenum and non-plenum applications.

B. Size as required or as indicated on Drawings.

C. Provide associated fittings as required.

D. Manufacturer: Carlon Plenum-Guard series or equivalent.

2.3 FIBER OPTIC CABLE

A. Single-mode Cable

1. OFCP rated
2. 900 μm tight buffer twelve-fiber distribution style.
3. 9 / 125 μm diameter.
4. 10Gb/s @ 1310 nm for distances up to 5,000 meters.
5. Manufacturer: General Photonics # AP0121PNU or approved equal.

2.4 MISCELLANEOUS PRODUCTS

A. Wall Mounted Splice Box

1. Twelve removable / tilt down splice trays.
2. Each splice tray capable of holding (24) splices with storage capacity of one meter of fiber per splice.
3. Lockable steel enclosure.
4. Manufacturer: Panduit FWME8 series or equivalent.

B. Connectors

1. Style and specifications as required by owners equipment.
2. Factory polished. **FIELD POLISHED CONNECTORS NOT ACCEPTABLE.**
   a. Factory polished pigtails terminated to the distribution cable by either fusion splicing or mechanical splicing with gradient matching gel (Panduit Opti-Cam or equivalent).
   b. Factory polished connector with mechanical termination directly to the distribution cable utilizing gradient matching gel (Panduit Opti-Cam or equivalent).
   c. Pre-terminated cassette with pre-terminated MTP type fiber connector on the distribution cable.

C. Patch Panel

1. Standard 19” rack mounting tray with removable top cover. Integral slack storage spools.
   a. Fiber Adapter Panels as required if utilizing pigtail connectors or Opti-Cam connectors.
   b. Cassettes as required if utilizing MTP type system.
2. Manufacturer: Panduit FMT2 with CFAPPBL2 or approved equal assembly.

D. Identification:

1. Panduit # LS5 or Pan Mark labeling systems, or equivalent. Hand lettering not acceptable.

PART 3 – EXECUTION

3.1 STORAGE

A. Store fiber optic cable in cool, dry space prior to installation.

3.2 GENERAL

A. Install in accordance with NEC, EIA/TIA Standards, product listing, and manufacturer's recommendations and instructions.

B. Cable

1. Route cables parallel or perpendicular to building construction.
2. Cable to be enclosed in raceway as described in Section 2.02 of this Specification unless otherwise indicated on Drawings.
3. Identify ends of cables as directed by Owner/Engineer.
4. Bending radius as per cable specifications.
5. All cable runs shall be continuous between termination points; NO SPLICING.

3.3 TESTING REQUIREMENTS

A. All fiber optic strands shall be tested and certified for EIA/TIA 568 standards. These standards require the following:

1. Attenuation loss not to exceed 3.0 dB/km @ 850 nm for 50/125 multimode cables and 0.65 dB/km @ 1310 nm for 9/125 single mode cables.
2. 0.75 dB per mated pair of connectors.
3. 0.30 dB per splice.

B. Using a light source/power meter, test each fiber for overall attenuation loss. Submit meter readings for each fiber with Record Manuals.

C. Electrical Contractor responsible for cost to replace all unsatisfactory cables due to breaks, fractures, and bad splices as determined by testing.

3.4 CLEANING

A. **Clean** and **vacuum interior** to remove all wire and insulation scraps, dust and dirt.

B. Clean all exposed surfaces immediately prior to final inspection.

END OF SECTION

SECTION 27 4116 – MEETING ROOM MULTI-MEDIA SYSTEM

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Provide complete and operational multimedia reinforcement system for the Meeting Room as shown on Drawings.

B. Work furnished and installed by others

1. The Owner will provide PoE network equipment and internet service.

C. Description of System

1. The system shall provide A/V presentation through the provided TV via wired HDMI and wireless program sources.
2. The system shall support virtual meetings via the provided webcam and networked small form factor Mini PC (NUC).

1.2 SUBMITTALS

A. Shop Drawings

1. Submit information in accordance with Section 260500.
2. Indicate mounting details, cabinet dimensions, connection diagrams, and description of system functions.

B. Record Manuals

1. Submit information in accordance with Section 260500.
2. Include manufacturer's data for adjustment, operation and maintenance of equipment and name of service organization.

PART 2 – PRODUCTS

2.1 MANUFACTURER/SUPPLIER

A. The system specified is based on equipment as manufactured Extron and other manufacturers as listed.

B. All references to model numbers and other pertinent information is intended to establish the standards of operational concepts, performance, quality and appearance which must be met.

C. Acceptable suppliers:

1. AVI, 1930 East Century Avenue, Bismarck, North Dakota, (701) 223-3800.
2. The Computer Store, 1100 S Broadway, Minot, North Dakota, (701) 838-3967.

3. TriCorne Audio Inc, 4023 State Street, Bismarck, North Dakota, (701) 258-6912.

2.2 SMART TV (BY OWNER)

A. 65” Class LED TV
B. 4K UHD
C. Minimum 120 Hz or faster refresh rate.
D. Smart Capable with Integral LAN port.
E. HDMI inputs as required.
F. Manufacturers: LG, Samsung, Sharp, Sony, Toshiba, or Vizio.

2.3 VIRTUAL MEETING EQUIPMENT

A. NUC.

1. Intel Core i5 Processor with minimum operating speed of 4GHz.
2. Integral SSD hard drive (250 GB minimum)
3. 8 GB Memory minimum.
4. I/O: Ethernet port, HDMI, USB-C.
5. Windows, Latest Version, 64 bit operating system.
6. Wireless Keyboard and Mouse with high output USB dongle.
7. Manufacturer: Lenovo: #TSC2-IP

B. Webcam.

1. 4k camera with electronic pan/tilt/zoom with auto frame technology.
2. Integral full range stereo speakers with DSP.
3. Integral 27-microphone array.
4. USB plug and play, compatible with Windows version provided on NUC.
5. Manufacturer: Biamp Parle #VBC2800 or approved equal.

2.4 PRESENTATION EQUIPMENT

A. Tabletop Controller.

1. Allows one touch option to join Microsoft Teams meetings.
2. Include link box as required.
3. Include cabling between controller and MTR connector.
    a. Manufacturer: Lenovo: #12WE000BUS

B. Tabletop Interface.

1. Flip-top style flush mount box for power and A/V connections with cable pass through cover.
2. Internal Devices
    a. One retractable HDMI
    b. One retractable White Cat 6 RJ45 (telco)
    c. One retractable Blue Cat 6 RJ45 (data).
    d. One Nema 5-15 power receptacle with USB A and C power.
3. Manufacturer: Extron #CableCubby 500 series or approved equal.

2.5 MISC.

A. Provide wall mounting brackets for all equipment as required for complete system installation. Ensure TV bracket provides proper clearance for the other equipment.

B. Provide all HDMI, USB, CAT6, and AUDIO patch cords as required for complete system.

PART 3 – EXECUTION

3.1 STORAGE

A. Store public address components in a cool, dry space prior to installation.

3.2 INSTALLATION

A. General

1. Verify exact mounting height/position of TV with Owner prior to installation.
2. Install NUC and Presentation Gateway concealed behind the TV.
   a. Carefully support all cables to ensure they are properly concealed behind the TV.
   b. Route Tabletop HDMI through the Presentation Gateway (not connected directly to a TV input).
3. Verify exact mounting location of the Tabletop Interface with Owner prior to installation in meeting room table (provided by others).
4. Obtain required IP addresses for TV, NUC, and Gateway from Owner and perform complete setup of each device.

3.3 TESTS

A. Prior to final inspection, verify that the multimedia system is in proper working condition. Furnish letter of verification to Engineer indicating that the system has been tested by a manufacturer's representative. List date of test and name of manufacturer's representative. Division 26 contractor responsible for test and scheduling.

3.4 INSTRUCTIONS

A. Manufacturer's representative shall instruct Owner in proper operation, maintenance and testing of the complete system. Indicate on letter of verification, name of Owner's representative receiving instructions.

B. Record instructions and include with Record Manuals in accordance with Section 260500.

3.5 CLEANING

A. **Clean** and **vacuum interior** to remove all wire and insulation scraps, dust and dirt.

B. Clean all exposed surfaces immediately prior to final inspection.

END OF SECTION

SECTION 27 1533 – TV SIGNAL CABLING

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Provide TV Signal Cabling System as shown on Drawings.

B. Work Furnished and Installed by Others

1. Building service entrance cable to the TV termination point not in contract.

C. Description of System

1. The system shall have the capability to distribute signals supplied by the local cable company. Each TV outlet will require a separate feed from the TV distribution point(s). The signal shall be distributed to the rooms in the following manner:
   a. When in the normal state, all programs will be distributed to all the rooms simultaneously.
2. The system shall provide for expansion of the system of future inputs, up to eight (8) total.

1.2 SUBMITTALS

A. Shop Drawings

1. Submit information in accordance with Section 260500.
2. Indicate mounting details, connection diagrams and description of system functions.

B. Record Manuals

1. Submit information in accordance with Section 260500.
2. Include manufacturer's data for adjustment, operation and maintenance of equipment and name of service organization.
3. Provide multiple copies, one to remain in central cabinet, other copies for Record Manuals.

PART 2 – PRODUCTS

2.1 MANUFACTURER/SUPPLIER

A. The system specified is based on equipment as manufactured by Blonder Tongue and other manufacturers as listed. All reference to model numbers and other pertinent information is intended to establish the standards of operational concepts, performance, quality and appearance which must be met.

B. Acceptable Suppliers:

1. AVI Systems, 1930 East Century Avenue, Bismarck, ND (701) 258-6360.
2. Computer Store, 1100 S Broadway, Minot, ND (701) 838-3967.
3. Data Connections, 4016 37th Avenue NW, Mandan, ND (701) 426-8771.

4. Dell-Comm, Inc., 812 South 18th Street, Bismarck, ND (701) 222-2887.
5. Kohler Communications Inc., 1429 Main South, Dickinson, ND (701) 225-5554.
6. Tricorne Audio, 4023 State Street, Bismarck, ND (701) 258-6912.

2.2 SPLITTERS

A. Radiation shielded with one input and outputs as required.

B. Meet CATV and SMATV requirements for RF shielding.

C. 5 MHz to 2.4 GHz frequency range.

D. Connections to use F type shielded hex crimped connectors.

E. All ports have power-pass.

F. Manufacturer: Blonder Tongue DCL series or equivalent.

2.3 OUTLETS

A. TV Jacks: F-type connector supplied with 75 ohm self-terminating F-type coupler for SUB/VHF/CATV/UHF. Manufacturer: Panduit Mini-Com #CMFSR Series.

B. Faceplates: Single gang, vertical faceplate accepting modular jack(s). Manufacturer: Panduit #CFP Series plates. Color as selected by Architect.

C. Where TV and voice/data outlets are shown ganged together on the Drawings, device plates furnished under Section 271500.

2.4 CABLE

A. Cable

1. RG-6
   a. #18 AWG .040 copper.
   b. 100% foil/60% aluminum braid/100% foil/40% aluminum braid.
   c. Type RG-6 Quad Shield Coax.
   d. Plenum-rated where installed above accessible ceilings and not in raceway.
   e. Manufacturer: Belden #5339Q5 or #6339Q8 (plenum-rated), or equivalent.
2. RG-11
   a. #14 AWG copper solid copper.
   b. 100% foil/60% aluminum braid/100%foil/40% aluminum braid.
   c. Type RG-11 Quad Shield Coax.
   d. Plenum-rated where installed above accessible ceilings and not in raceway.
   e. Manufacturer: Belden #70084NH-series or equivalent.

B. Cable Management:

1. Six inch die-cast aluminum distribution rings: Manufacturer: Allen Tel #GB13C or equivalent.
2. Velcro cable-ties: Manufacturer: Panduit HLX series or equivalent.
3. Bridle rings: Manufacturer: B-Line BR series or equivalent.

PART 3 – EXECUTION

3.1 STORAGE

A. Store TV signal cabling components in a cool, dry space prior to installation.

3.2 INSTALLATION

A. Install in accordance with Code, product listing, and manufacturer's recommendations.

B. Contractor shall adjust and provide all other assistance required at final inspection to bring the system satisfactorily on-line.

C. Service Conduit

1. Provide CATV service entrance conduit, stubbed to telephone terminal board from property line.
2. Verify service entrance conduit size, minimum 2”, and property line location with serving utility.
3. Provide bushing or connector at each conduit stub.
4. Provide pull wire in each CATV conduit run.

D. Cable

1. Route cables parallel or perpendicular to building construction.
2. Support cables with bridle rings, maximum 6'-0” on center.
3. Bundle multiple cable runs together with velcro cable ties, maximum 3’-0” on center.
4. Identify ends of cables with room designations as directed by Owner.
5. Minimum one inch bending radius.
6. All cable runs shall be continuous, NO SPLICING.

E. Conduit

1. Provide minimum 3/4" conduit, where cable is concealed within new walls, in mechanical rooms and rooms without ceilings.
2. Cable not required to be enclosed in conduit where installed:
   a. In existing walls.
   b. Above existing plaster ceilings.
   c. Above accessible ceilings.

F. Provide F-type, shielded, hex-crimped connectors at all cable ends.

G. Provide splitters where indicated.

H. Outlets shall be properly shielded to eliminate any leakage of signal. Tap values shall be designed so that signal levels can be kept at no more than +5 dB on Channel 41 @ 300 MHz.

I. Exercise particular care for installation of control rough-in boxes to ensure plumb and level placement.

J. Entire installation to comply with Owner's cable requirements.

3.3 TESTS

A. Prior to final inspection, verify that the system is installed in accordance with serving utility standards, and in proper working condition. Furnish letter of verification to Engineer indicating that the system has been tested by a manufacturer's representative. List date of test and name of manufacturer's representative.

3.4 INSTRUCTIONS

A. Manufacturer's representative to instruct Owner in proper operation, maintenance and testing of the complete system. Include name of Owner's representative in letter of verification.

3.5 CLEANING

A. **Clean** and **vacuum interior** to remove all wire and insulation scraps, dust and dirt.

B. Clean all exposed surfaces immediately prior to final inspection.

END OF SECTION

SECTION 28 0500 – DIVISION 28 GENERAL PROVISIONS

PART 1 – GENERAL

1.1 DESCRIPTION

A. The provisions and requirements of Section 260500 shall be applicable to Division 28.

B. All Division 28 work shall be included under the Division 26 contract.

C. The Contractor shall take special note that any conflicts between the Contractor and any Division 28 subcontractors shall not become an issue of the Engineer or Owner. It shall be the Contractor's responsibility to coordinate with the Division 28 subcontractor/s to determine where their work leaves off and where the subcontractor's work begins. The Contractor shall be responsible for all specified work including the operations of work under Division 28.

END OF SECTION

SECTION 28 1000 – CONTROLLED ACCESS SYSTEM

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Furnish and install rough-ins and provide raceway and cabling to the suggested controlled access control panels for a complete controlled access system by owners vendor.

2. All work in conjunction with this installation shall meet the provisions of the National Electrical Code and any other applicable codes.

1.2 SUBMITTALS

A. Shop Drawings

1. Provide information in accordance with Section 260500.
2. Indicate:
   a. Mounting details.
   b. Wiring diagrams.
   c. Floor plan layout of devices.

PART 2 – PRODUCTS

2.1 MANUFACTURER/SUPPLIER

A. The system specified is based on equipment as manufactured by Keyscan Access Control Systems and Altronix Power Supplies. All references to model numbers and other pertinent information is intended to establish the standards of operational concepts, performance, quality and appearance which must be met.

2.2 CENTRAL SYSTEM

A. Proximity Readers

1. Indoor/Outdoor IP65 rated.
2. Universal proximity and mobile credential compatibility.
3. Wiegand output.
4. Transmitting frequencies: 125 kHz, 13.56 MHz, and 2.4 GHz.
5. Supply Voltage Range 5/16 VDC.
6. Supplied and installed by others.

B. Electric Door Strikes.

1. 24 Volt DC.
2. Supplied and installed by others.

C. Motorized Electric Latch (panic device)

1. 24 Volt DC.
2. Low Power Version
   a. 1.0 Amp inrush (0.5 sec)
   b. 0.15 Amp holding.
3. Power transfer hardware.
4. Supplied and installed by others.

D. Door Sensors

1. Man-Door Type
   a. Flush-mount type suitable for steel or wood doors.
   b. Suitable for supervised inputs.
   c. Manufacturer: Interlogix Model #1078 Series or equivalent.

2. Overhead-Door Type
   a. Surface-mount type with 3' armored cable lead.
   b. Suitable for supervised inputs.
   c. Include mounting bracket suitable for application.
   d. Manufacturer: Interlogix Model #2500 Series or equivalent.

E. Request to Exit Sensor

1. Dual technology wall or ceiling mount motion sensor with adjustable coverage.
2. DPDT contact to shunt door position sensor.
3. Low Voltage (12 – 30 VAC/VDC)
4. Interlogix Model #RCR-REX or approved equal

F. Cabling

1. Card Reader Cable.
   a. 6 conductor, 22 AWG, shielded.
   b. Plenum rated.
   c. 500' length limit.
2. Electric Strike Cable.
   a. 2 conductor, 18 AWG, shielded.
   b. Plenum rated.
   c. 500' length limit.
3. Door Sensor Cable
   a. 2 conductor, 22 AWG.
   b. Plenum rated.
   c. 500' length limit.
4. Network Cable
   a. Cat 6. See Specification 271500 for details

PART 3 – EXECUTION

3.1 STORAGE

A. Store access system components in a cool, dry space prior to installation.

3.2 INSTALLATION

A. General

1. Install in accordance with Code, NRTL-listing and manufacturer's recommendations.
2. Wiring to comply with all National, State and Local Codes.
3. Locate devices as generally shown on Drawings and as indicated on installation instructions.
4. Provide conduit where cables are concealed in walls, in mechanical rooms, and in rooms without ceilings.

B. Proximity Readers

1. Standard type to be installed on solid walls. Use mullion type on any curtain wall systems or controlled doors with glass sidelights. Coordinate installation of any mullion style readers with supplier of frame system.
2. Where installed on masonry walls, readers shall be installed such that the top of the reader is even with block coursing

3.3 CLEANING

A. **Clean** and **vacuum interior** to remove all wire and insulation scraps, dust and dirt.

B. Clean all exposed surfaces immediately prior to final inspection.

END OF SECTION

SECTION 28 4611 – FIRE ALARM AND DETECTION

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Furnish and install a complete addressable fire alarm and detection system in accordance with NFPA 72 and this specification.

B. Work not included

1. Where required, the Owner shall be responsible for:
   a. Line lease or service fees associated with signal transmission (alarm, supervisor, and trouble) to a remote central station.
   b. Any proprietary interface equipment not specified herein and required by the Owner's monitoring service.

C. Description of System

1. General: Provide a complete, non-coded, addressable, microprocessor-based fire alarm system with initiating devices, notification appliances, and monitoring and control devices as indicated on the Drawings and as specified herein.
2. Software: The fire alarm system shall allow for loading and editing instructions and operating sequences as necessary. The system shall be capable of on site programming to accommodate system expansion and facilitate changes in operation. All software shall be stored in a non-volatile programmable memory within the fire alarm control panel (FACP). Loss of primary and secondary power shall not erase the instruction stored in memory.
3. History Logs: The system shall provide a means to recall alarms and trouble conditions in chronological order for the purpose of recreating an event history. Separate alarm, supervisory and trouble logs shall be provided.
4. Wiring/Signal Transmission
   a. Transmission shall be addressable signal transmission, dedicated to fire alarm service only.
   b. Circuit Supervision: Circuit faults shall be indicated by a trouble signal at the fire alarm control panel. Provide a distinctive indicating audible tone and alphanumeric annunciation.
   c. System connections for initiating, signaling line circuits and notification appliance circuits shall be Class A or Class B as described in Part 3 of this specification.
5. Analog Smoke Detectors
   a. Monitoring: The FACP shall individually monitor detectors for calibration, sensitivity, and alarm condition, and shall individually adjust for sensitivity. The FACP shall determine the condition of each detector by comparing the detector value to the stored values.
   b. Environmental Compensation: The FACP shall maintain a moving average of the detector's smoke chamber value to automatically compensate for dust, dirt, and other conditions that could affect detection operations.
   c. Programmable Sensitivity: Smoke detectors shall have multiple sensitivity levels, programmed and monitored from the FACP.
   d. The FACP shall automatically indicate when an individual detector needs cleaning.

e. The FACP shall continuously perform an automatic self-test on each detector, which will check detector electronics and ensure the accuracy of the values being transmitted. Any detector that fails this test shall indicate a trouble condition.

6. Analog Heat Detectors
   a. Monitoring: The FACP shall individually monitor detectors for alarm condition and shall individually adjust for fixed temperature sensing and rate-of-rise sensing. The FACP shall determine the condition of each detector by comparing the detector value to the stored values.
   b. Programmable Sensitivity: Heat detectors shall have rate-of-rise temperature detection values selectable at the FACP for either 15° F or 20° F per minute. Fixed temperature sensing is independent of rate-of-rise sensing and shall operate at either 135° F or 155° F.
   c. The FACP shall continuously perform an automatic self-test on each detector, which will check detector electronics and ensure the accuracy of the values being transmitted. Any detector that fails this test shall indicate a trouble condition.
7. Power Requirements
   a. The FACP and each required expansion panel shall receive 120-volt AC power via a dedicated 20-ampere circuit breaker from the nearest panelboard. The incoming power to each panel shall be supervised so that any power failure will be indicated at the FACP and sound a trouble signal. The primary power branch circuit supplying fire alarm equipment shall supply no other loads. The circuit breaker:
      1) Location shall be permanently identified at the corresponding control unit.
      2) Shall have a listed circuit breaker locking device installed.
      3) Shall have a red marking which shall not damage the overcurrent protective device or obscure the manufacturer's markings.
      4) Shall be permanently identified as to its purpose: "FIRE ALARM" for fire alarm systems, "EMERGENCY COMMUNICATIONS" for emergency communications systems, and "FIRE ALARM/ECS" for combination fire alarm and emergency communications systems.
   b. The FACP shall be provided with sufficient battery capacity to operate the entire system upon loss of normal AC power in a normal supervisory mode for a period of 24 hours with 5 minutes of alarm operation at the end of this period. The system shall automatically transfer to battery standby upon power failure. All battery charging and recharging operations shall be automatic. System batteries shall be supervised so that a low battery condition or disconnection of the battery shall be indicated at the control panel.
   c. All circuits requiring system-operating power shall be 24-volt DC and shall be individually fused at the control panel.
   d. The system shall support 100% of the addressable devices in alarm operation at the same time, under both primary (AC) and secondary (battery) power conditions.
8. Fire Sprinkler Monitoring
   a. Water Flow: Activation of a water flow switch shall initiate a general alarm operation.
   b. Valve Supervisory Switch (Tamper Switch): The activation of any valve supervisory switch shall activate system supervisory operations.
   c. Activation of either a water flow switch or valve supervisory switch shall distinctly report which device is in alarm at the FACP and any required remote annunciator(s).

1.2 REQUIRED SYSTEM FUNCTIONS

A. Priority of Signals: Alarm events have the highest priority. Subsequent alarm events are queued in the order received and do not affect existing alarm conditions. Supervisory and Trouble events have second-level and third-level priority respectively. Events of a higher-level priority take precedence

over events of lower priority even though the lower-priority condition occurred first. Annunciate all events regardless of priority or order received.

B. Non-interfering: The activation of an addressable device does not prevent receipt of signals from subsequent activations.

C. Transmission to Remote Central Station: The FACP shall have the capability to automatically route alarm, supervisory, and trouble signals to a central station via Internet Protocol (IP) over the public open Internet.

D. Types of Signaling: The FACP shall be NRTL-listed for the applicable types of signaling methods used, i.e.: Temporal Coded, Non-Coded, March Time and/or Internet Protocol.

E. Annunciation: Operation of alarm and supervisory initiating devices shall be annunciated at the FACP and any required remote annunciator(s), indicating the location and type of device.

F. General Alarm: Activation of an alarm initiating device shall include:

1. Indication of alarm condition at the FACP and any required remote annunciator(s).
2. Identification of the device that is the source of the alarm at the FACP and any required remote annunciator(s).
3. Operation of all audible and visual notification appliances throughout the building until silenced at the FACP and any required remote annunciator(s). Audible alarm notification shall operate steady or match existing building convention.
4. Shutting down designated air handling equipment, and activating smoke dampers and exhaust fans as required by alarm input.
5. Have the capability to automatically route the signal to a Remote Central Station.
6. The control panel shall be capable of bypassing Items 4 and 5 through the use of programmable touch pads on the front of the control panel. These touch pads shall be password-protected to prevent unauthorized tampering.
7. Record the event in the FACP historical log.
8. Closing doors normally held open by magnetic door holders.
9. Initiate elevator recall in accordance with ASME/ANSI A17.1, when designated fire alarm detectors are activated.
10. Initiation of smoke control sequence.
11. Unlocking of designated doors.

G. Supervisory Operations: Upon activation of a supervisory device such as fire pump failure, low air pressure switch, and tamper switch, the system shall operate as follows:

1. Activate the system supervisory service audible signal and illuminate the LED at the FACP and any required remote annunciator(s).
2. Pressing the Supervisory Acknowledge key will silence the supervisory audible signal while maintaining the supervisory LED “on” indicating off-normal condition.
3. Record the event in the FACP historical log.
4. Transmission of supervisory signal to Remote Central Station.

H. Alarm Silencing: If the “Alarm Silence” button is pressed, all audible alarm signals shall cease. (Visual signals shall continue to operate.)

I. System Reset:

1. The “System Reset” button shall be used to return the system to its normal state. Display messages shall provide the operator assurance of the sequential steps (“IN PROGRESS”, “RESET COMPLETED”) as they occur. The system shall verify all circuits or devices are restored prior to resetting the system to avoid the potential for re-alarming the system. The display message shall indicate, “ALARM PRESENT, SYSTEM RESET ABORTED.”
2. Should an alarm condition continue, the system will remain in an alarmed state.

J. Drill: A manual activation (drill) switch shall be provided to initiate an alarm on the FACP.

K. Manual Control: Manual controls shall be supervised so that an “off normal” position of any switch shall cause an “off normal” system trouble. The “off normal” status shall be clearly identified in plain language on the FACP alphanumeric display.

1. Manual Bypass Control: The ability to perform a manual bypass of selected automatic functions shall be provided.
2. Circuit Enable/Disable Control: The system shall have provisions for disabling and enabling each circuit individually for maintenance or testing purposes.

L. WalkTest: The system shall be capable of being tested by one person without returning to the control panel to reset the system after each alarm. Enabling the one-person test feature at the FACP shall activate the “One person Testing” mode of the system as follows:

1. The control panel shall automatically log each alarm and each trouble condition tested, and reset the system for the next condition to be received. Should the walktest feature be left off for a preprogrammed length of time without any activity, the system shall revert to the normal operating mode automatically.
2. The city circuit connection and suppression release circuits shall be bypassed for the testing group.
3. Control relay functions associated to the testing group shall be bypassed.
4. The FACP shall indicate a trouble condition.
5. The alarm activation of any initiating device in the testing group shall cause the audible notification appliances to sound a code to identify the device.
6. The control panel shall automatically reset itself after signaling is complete.
7. Any momentary opening of an initiating or notification appliance circuit wiring shall cause the audible signals to sound for 4 seconds indicating the trouble condition.

1.3 SUBMITTALS

A. Shop Drawings

1. Submit information in accordance with Section 260500.
2. Indicate:
   a. Mounting details.
   b. Cabinet dimensions.
   c. Wiring diagrams.
   d. Description of devices.
   e. Floor plan layout of fire alarm system indicating location of devices, wiring between devices, and intensities of audible and visual appliances. Upon request, the Engineer will furnish AutoCAD files of the floor plan. Submit one copy to Engineer for approval. Upon receipt of Engineer’s approval, provide **additional four** copies. Submit one copy to Engineer. Remaining copies for Contractor use at the project site and for Record

Drawing/Manual submittal at project closeout (redlined to indicate actual conditions of installation).

B. Record Manuals

1. Provide information in accordance with Section 260500.
2. Include complete data for operation and maintenance of the system, consisting of:
   a. Wiring diagrams.
   b. Testing.
   c. Maintenance.
   d. Description of system operation.
   e. Addition of devices.
   f. Frequency of testing procedures.
   g. All data referenced in NFPA 72, 7.5.
3. Provide multiple copies (including shop drawing connection/riser diagram), one to remain in control panel, other copies for Record Manuals.

1.4 MANUFACTURER/SUPPLIER

A. The system specified is based on equipment as manufactured by Johnson Controls Fire Protection: Autocall or Simplex. All reference to model numbers and other pertinent information is intended to establish the standards of operational concepts, performance, quality and appearance, which must be met.

B. Other acceptable manufacturers: Edwards Systems Technology, Potter Electric Signal, or Siemens Fire Safety.

1. Being listed as an acceptable manufacturer in no way relieves obligation to provide all equipment and features in accordance with this specification.

C. All equipment shall be NRTL-listed, and shall be furnished by one manufacturer to ensure listing/equipment compatibility as required by NFPA 72.

D. Supplier providing equipment and services under this Section shall have:

1. A factory-authorized service center located in North Dakota within 250 miles of the project site. Referenced service center shall be under direct control of the Supplier, staffed by employees of the Supplier, and contain an inventory of replacement material requisite for timely maintenance. Referenced service center shall be operational for a minimum five-year period or have equivalent five-year industry experience with installation and programming prior to bid opening.
2. A minimum of one employee at the above referenced service center certified by National Institute for Certification in Engineering Technologies (NICET). Certification shall be in the Fire Protection Engineering Technology field, Fire Alarm Systems sub-field, and shall be minimum Level III.

E. Acceptable Suppliers:

1. ACS, 3410 13th St NE, Minot, ND (701) 446-8840.
2. Electro Watchman, Inc., 4715 19th St SE, Mandan, ND (701) 258-6169.
3. Forte, 1930 East Century Avenue, Bismarck, ND (701) 258-6360.
4. Nardini Fire Equipment Co. Inc., 303 20th St N, Fargo, ND (800) 950-1139.
5. NewVison, 3320 Hamilton St. Unit 5, Bismarck, ND 58503 (701) 222-8888.

6. SimplexGrinnell, 2821 Fiechtner Drive, Fargo, ND (800) 342-4668.
7. Systems Technology, 1424 44th St N, Fargo, ND 58102 (701) 235-0558.

PART 2 – PRODUCTS

2.1 CENTRAL SYSTEM

A. Fire Alarm Control Panel (FACP)

1. General: Comply with UL 864, "Control Panels for Fire-Protective Signaling Systems."
2. Cabinet:
   a. Steel enclosure with lockable, hinged door for front access. Surface or flush-mount style as indicated on the Drawings.
   b. Color: Red when surface-mounted in equipment rooms, and beige, black or gray when flush-mounted in other locations.
3. The following FACP hardware shall be provided:
   a. Power limited base panel with 120-volt AC input power.
   b. Addressable point capacity: Size for requirements of Drawings and Specifications, minimum of 240 points expandable to 1,000 points, inclusive of inputs and outputs in any combination (Autocall #4010ES series).
   c. Appropriate initiating device circuit (IDC) and notification appliance circuit (NAC) modules to support Class A or Class B circuits as described in Part 3 of this specification
   d. Alphanumeric Display and System Controls: FACP shall include an 80 character LCD display to indicate alarm, supervisory, and component status messages and shall include a keypad for use in entering and executing control commands.
   e. Notification appliance circuits: Size for requirements of Drawings and Specifications, minimum of 4 required.
   f. Two form "C" auxiliary output circuits (rated 2A @ 24-volt DC, resistive), operation is programmable for trouble, alarm, supervisory or other selective control operations. Provide capability for switching up to 1/2 A @ 120-volt AC, inductive loads.
   g. Secondary (emergency) power supply including: battery(s), charger and automatic transfer switch. Battery(s) shall be sealed lead-acid type.
   h. An IP communicator to automatically route the alarm signals to a Remote Central Station.
      1) Designed to monitor the status of the FACP and report to a Remote Central Station as follows:
         a) Alarms.
         b) Troubles.
         c) Supervisory conditions.
      2) The transmission path shall be supervised at an interval of 60 minutes or less.
      3) Module Types:
         a) Direct connect IP communication module.
         b) IP dialer capture module to convert Digital Alarm Communicator information to IP protocol.
   i. Supervised serial communication circuit for control and monitoring of remotely located LCD annunciator(s) and I/O panels.

B. Expansion Panels

1. NAC Addressable Controller
   a. Stand-alone panel providing power and communications interface for addressable notification appliances with:

1) Three isolated output channels for addressable notification appliance control.
2) Channels that are Signaling Line Circuits (SLC's), each rated at 2-1/2 A and for up to 63 addressable notification appliances (up to 189 per controller).
3) Individual supervision of each appliance allowing Class B wiring to be branch connected and "T" tapped.
4) Comply with UL 864.

b. Input power: 120-volt AC.

2. NAC Extender
   a. Stand-alone panel capable of:
      1) Powering a minimum of four non-addressable notification appliance circuits. Each circuit rated 2 A @ 24-volt DC.
      2) Controlling non-addressable notification appliances.
   b. Internal power supply and battery charger capable of charging internal-mounted batteries or batteries mounted in an external cabinet where required.
   c. Connected to the FACP via addressable communications circuit. Via the communications circuit each output notification appliance circuit can be individually controlled for general alarm or selective area notification.
   d. Alarms from the FACP shall signal the NAC extender panel to activate. The panel shall monitor itself and each of its NACs for trouble conditions and shall report trouble conditions to the FACP.
   e. Input power: 120-volt AC.

C. Alarm Initiating Devices

1. Manual fire alarm station:
   a. "Address capable"
   b. Non-coded single action.
   c. Provide two spare stations.
2. Automatic area smoke detection station:
   a. "Address" capable.
   b. Combination photoelectric smoke and fixed heat plug-in "head" unit which mounts to a twist-lock base.
   c. Individual station sensitivity levels are selected and monitored at the control panel.
   d. Self-restoring.
   e. White or Black color.
      1) Verify color for each area/room with architect and engineer.
   f. Comply with UL 268.
   g. Provide three spare stations.
3. Automatic duct smoke detection station:
   a. "Address" capable.
   b. Automatic photoelectric smoke detection station with associated duct housing and sampling tubes as required.
   c. Refer to Motor and Equipment Schedule for equipment requiring duct detection.
4. Automatic area heat detection station:
   a. "Address" capable.
   b. Combination rate-of-rise and fixed temperature rate compensated sensing plug-in "head" unit, which mounts to a twist-lock base.
   c. Individual station rate-of-rise temperature levels are selected and monitored at the control panel. Fixed temperature level is independent of rate-of-rise levels and shall operate at 135° F or 155° F. Select appropriate mode.

d. Locations requiring temperature ratings exceeding 155° F may include hardwired detector on an addressable base.
e. Self-restoring.
f. Low profile.
g. White or Black color.
1) Verify color for each area/room with architect and engineer.
h. Provide two spare stations of each rating.

D. Alarm Notification Appliances

1. Audible alarm notification appliance
a. Piezoelectric type horn.
b. Flush mount.
c. Red or White finish.
1) Verify color for each area/room with architect and engineer.
d. Comply with UL 464.
e. Class A operation.
2. Visual alarm notification appliance
a. Xenon or LED flash tube and associated lens/reflector system.
b. Comply with Americans With Disabilities Act (ADA).
c. Minimum of four (4) field selectable strobe intensity settings: 15, 30, 75 and 110 candela. All settings shall be UL 1971 listed for both wall and ceiling mount applications. Select strobe intensity for each unit as dictated by location and NFPA 72, 18.5.
d. "Fire" lettering on housing or lens.
e. Red or White finish.
1) Verify color for each area/room with architect and engineer.
f. Comply with UL 1971.
g. Class A operation.
3. Where shown ganged together on Plans, combine audible and visual alarm notification appliances into one device.
4. Manufacturer: Same as control panel.

E. Auxiliary Devices

1. Magnetic door holder:
a. 24 volt or match existing.
b. Extra low profile for use with concealed wiring.
2. Individual addressable module (IAM):
a. Module provides supervised, location specific addressability, to a single initiating device by monitoring normally open, dry contacts. Closure of contacts initiates an alarm or trouble signal as required by the device being monitored.
b. Used to provide addressable monitoring of devices such as flow or tamper switches, etc.
c. Powered directly from signaling line circuit. No separate power source required.
d. Mount in single-gang box, minimum 2-1/2” deep.
e. Included with flush or surface cover as required.
f. Provide a separate IAM for each device being monitored.
3. Individual addressable relay module (Relay IAM):
a. Module provides control and status tracking of a Form “C” SPDT, dry contact.
b. Module power and communications provided directly from the signaling line circuit.
c. Used to provide addressable control functions such as elevator recall, HVAC control, fan control, damper control, etc.
d. Mount in standard 4” square box.

e. Included with flush or surface cover as required.

F. Manual Shutdown

1. Manual shutdown capability included with motor starter.

G. Automatic Shutdown

1. Automatic shutdown capability for air handling equipment where required by NFPA 90A.
2. Locate fan shutdown relays remote from fire alarm control panel, controlled by integral relay in fire alarm control panel, with bypass switch.
3. Refer to Motor and Equipment Schedule for equipment requiring automatic shutdown.
4. Wiring: Two-wire parallel independent circuit to fire alarm control panel.

H. Remote Annunciator

1. Alphanumeric LCD display with the same "look and feel" as the FACP operator interface.
2. Status LED's provide system status in addition to LCD display information. Status LEDs included for:
   a. Alarm.
   b. System trouble
   c. System supervisory.
   d. Alarm silenced.
   e. Power on.
3. Should an abnormal condition be detected the appropriate LED shall flash. The unit audible signal shall pulse for alarm conditions and sound steady for trouble and supervisory conditions. When acknowledged, the LED shall remain on until reset.
4. Captive key switch enables following push buttons:
   a. Alarm acknowledge.
   b. Trouble acknowledge.
   c. Alarm silence.
   d. System reset.
   e. Supervisory acknowledge
5. Touchscreen type remote annunciator incorporating the same functionality as listed shall be acceptable.

I. Fire Sprinkler System Equipment

1. Flow switch(es) and valve supervisory switches furnished and installed by Fire Sprinkler Contractor, wired by Electrical Contractor.
2. Fire sprinkler alarm notification appliance (bell or audible-visual signaling unit) furnished by Fire Sprinkler Contractor, installed and wired by Electrical Contractor.

J. Elevator Fire Sprinkler/Power Module Switch

1. Interface with the elevator fire sprinkler/power module switch such that activation of the elevator and /or elevator equipment room fire sprinkler flow switch(es) shall disconnect the elevator power circuit via the power module shunt trip operator.
2. Interface with fire alarm voltage monitoring relay furnished with power module switch to comply with NFPA 72.
3. Provide fire alarm IAM(s) as required by elevator power module switch characteristics.
4. Refer to "Elevator Fire Sprinkler/Power Module Switch Interface" Detail on the Drawings.

PART 3 – EXECUTION

3.1 STORAGE

A. Store fire alarm components in a cool, dry area prior to installation.

3.2 INSTALLATION

A. General

1. Install in accordance with code, product listing, and manufacturer's recommendations.
2. Wiring to comply with all national, state and local fire codes.
3. All fire alarm circuitry shall be installed in raceway unless otherwise noted. Refer to Section 260533 for acceptable raceways.
4. Conductors:
    a. Quantity as required by manufacturer.
    b. Signaling Line Circuits (SLC):
        1) Two-conductor #18 AWG, twisted pair shielded or unshielded cable as per manufacturer requirements.
        2) NFPA 72 Class A, “T” tapping not permitted (exceptions as per NFPA 72, 12.3.8.1 acceptable).
    c. Alarm notification appliance circuits (NAC):
        1) Solid, #14 AWG minimum, size for maximum 5% voltage drop.
        2) NFPA 72 Class A, “T” tapping not permitted (exceptions as per NFPA 72, 12.3.8.1 acceptable).
        3) Audible appliances (horns) controlled separately from visual appliances.
        4) All visual appliances shall flash in synchronization.
    d. Miscellaneous Circuits: (such as magnetic door holders & etc.)
        1) Solid, #14 AWG minimum, size for maximum 5% voltage drop.
    e. Color Coding: Manufacturer/Supplier requirements.
    f. Enclosed in raceway system (i.e. conduit).
    g. To ensure proper supervision of initiating and indicating circuitry, three wires maximum per wire-nut.
5. Raceway Systems:
    a. Size raceway systems and junction boxes as per NEC.
    b. All junction boxes, junction box covers and raceway systems except those embedded directly in earth or concrete, or surface metal raceway systems (wiremold), shall be externally identified by permanent bright red paint suitable for the purpose, to easily distinguish from other communication or power raceway systems. Items shall be painted prior to installation. In addition to field painted conduit, factory painted conduit as manufactured by Allied Tube & Conduit (Fire Alarm™ EMT), acceptable.
    c. Route outgoing and return Class A circuits in separate conduits (exceptions as per NFPA 72, 12.3.8.1 acceptable).
    d. Multiple circuits acceptable in same raceway system.
6. Terminations:
    a. Connect all devices according to manufacturer's data.
    b. Made on terminal strips with separate joint for each conductor.
    c. Number identify all strips as shown in wiring diagram included with manual.
    d. Number identify all conductors to agree with terminal strip numbering.
    e. When required, end of line devices to be mounted on terminal strips in the FACP.
    f. Wire-nut terminating not acceptable.

7. Do not zone alarm notification appliances. Rather, route notification appliance circuits (NAC's) with signaling line circuits (SLC's). Terminate and jumper as required to maintain supervision on identified terminal strips.
8. Locate devices as generally shown on Drawings and as specifically indicated on installation instructions.
9. Remote fan shut-down relays to be mounted near controller or equipment.
10. Where control panel is shown to be surface-mounted, provide 3/4" grade AD, fire-resistant, gray painted (including edges), plywood backing.
11. Provide 1/2" conduit from fire alarm control panel to nearest network rack offering internet access. Provide a four-pair minimum Category 5e UTP data cable terminated to the IP communicator module. Ensure owner's internet access equipment complies with secondary power requirements as required by NFPA 72. If owner provided internet access is not available, provide additional dedicated IP equipment as required to obtain internet service in conformance with NFPA 72.
12. Provide elevator/fire alarm interface as per Section 262822.

B. Spot-Type Detectors

1. Locate as generally shown on Drawings and as specifically indicated in NFPA 72 and on installation instructions.
    a. All detectors in rooms with gas fired equipment shall include CO sensor.
2. Provide protective plastic wrapping to prevent entrance of construction dust. Field-install during construction. Remove immediately prior to supplier testing. Replace protective plastic wrapping and remove day of final inspection.
3. All smoke/heat detection devices shall be located a minimum of 3' from any supply, return, or exhaust air diffusers/grills.

C. Duct Detectors

1. Installed and arranged to automatically initiate general alarm.
2. Provide at a suitable location in the return air stream prior to exhausting from building or being diluted by outside air.
3. Provide at a suitable location in main supply duct on downstream side of filters.
4. Refer to Motor and Equipment Schedule for equipment requiring duct detection.
5. Locate as specifically indicated in NFPA 72 and on installation instructions. Coordinate with supplier's representative prior to installation, exact location to ensure accurate sampling of air stream. Provide quantity as required by duct geometry.
6. Do not install head on sampling tube base in housing until final supplier testing, unless a protective cover is included with the detector head.

D. Remote Annunciator

1. Flush mounting.
2. Gangable switch box as required.
3. Minimum two #14 AWG conductors and one #18 AWG twisted shielded pair, or as required by manufacturer.

E. Fire Sprinkler System Equipment

1. See Mechanical Drawings and Specifications for locations and quantities.
2. Valve supervisory switches:

a. Integral contact shall serve as supervisory initiating device for separate “Address”.
b. Supervisory only. Will not sound general alarm, or "Trouble".

3. Flow Switch:
   a. Consists of two Form “C” (NO-NC) contacts.
   b. One contact shall serve as alarm initiating device for separate “address”.
   c. Second contact shall control fire sprinkler alarm notification appliance. Connect to nearest 120 volt egress circuit. Provide transformer and relay as required.

3.3 TESTS

A. Prior to final inspection, verify that the fire alarm system is in proper working condition, free from false alarms. Furnish a letter of verification to Engineer indicating that the system has been tested by manufacturer's representative and is found to be complete and functional. List date of test and name of manufacturer's representative. Indicate in letter that testing was in accordance with NFPA 72, Chapter 14, including re-acceptance testing when applicable. Include copies in control panel and Record Manuals.

B. Notify Owner, Engineer, and Local Fire Marshall or Fire Chief one week in advance of scheduled tests. Electrical Contractor responsible for test coordination and scheduling.

3.4 INSTRUCTIONS

A. Manufacturer's representative shall instruct Owner in proper operation, maintenance and testing of complete fire alarm and detection system. Indicate on letter of verification, name of Owner's representative receiving instructions.

B. Record instructions and include with Record Manuals in accordance with Section 260500.

3.5 CLEANING

A. **Clean** and **vacuum interior** to remove all wire and insulation scraps, dust and dirt.

B. Clean all exposed surfaces immediately prior to final inspection.

END OF SECTION

SECTIOIN 28 4913 – RESCUE ASSUSTANCE SYSTEM

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Furnish and install a complete IP based Rescue Assistance System operating on an isolated/proprietary supervised type network.

B. Description of Work

1. System to operate as follows:
   a. Voice communication is initiated by depressing the Call Station button transmitting the signal to the Base Station. A programmable message and lighted button signals the caller that the alarm has been sent. The caller need not take any other action to communicate with the Base Station. An indicator light and screen message will signal the Base Station that a call has been received. Upon answering the call, a hands free, full-duplex communication channel is activated between the Base Station and Call Station.
   b. If the call is not acknowledged at the base station after a programmed amount of time, the call is forwarded to a pre-programmed Remote Call Center. When the call is answered at the Remote Call Center, a hands free, full-duplex communication channel is activated between the Remote Call Center and the Call Station. The call can be interrupted/intercepted by the Base Station at any time.
   c. In the event of a wiring fault, an indicator light and screen message appear on the Base Station.
   d. The entire system shall comply with the Americans with Disabilities Act Accessibility Guidelines.

1.2 SUBMITTALS

A. Shop Drawings

1. Submit information in accordance with Section 260500.
2. Indicate:
   a. Mounting details.
   b. Cabinet dimensions.
   c. Wiring diagrams.
   d. Description of devices.
   e. Floor plan layout of devices.
   f. Connection/riser diagram for specific project involved.

B. Record Manuals

1. Submit information in accordance with Section 260500.
2. Include information for operating and maintaining the system, including wiring diagrams, repair parts list, and all instructions accompanying equipment.

PART 2 – PRODUCTS

2.1 MANUFACTURER

A. The system specified is based on equipment as manufactured by Cornell Communications Solutions and other manufacturers as listed. All reference to model numbers and other pertinent information is intended to establish the standards of operational concepts, performance, quality and appearance which must be met.

2.2 EQUIPMENT

A. Control Panel (RACP)

1. Full-duplex communication.
2. Supervised peripheral devices.
3. Support for 8 devices.
4. Integral modem that connects with VoIP, and SIP telephone systems.
5. Integral 120 Volt power supply.
6. Standard IEA/TIA rack mount assembly (3RU).
7. Manufacturer: Cornell #SCM-4825.
    a. Include rack mounted 1500VA UPS for backup power to control panel

B. Expansion Module (RAEX)

1. Quantity as required to accommodate additional devices and/or to extend cabling distance limitations (320 feet) from devices to the control panel.
2. Support for 8 devices..
3. Wall mount enclosure.
4. Manufacturer: Cornell #ES-4808S
    a. Include wall mounted 24VDC power supply with 3 hour battery backup.
    b. Manufacturer: Cornell #B-5243A.

C. Base Station (RABS)

1. POE “telephone” style device with handset for communication.
2. Graphics display screen with customizable message displays.
3. Manufacturer: Cornell #A-4800BS.
    a. Include wall mount enclosure with window and semi-flush trim ring.
    b. Manufacturer: Cornell #BB-48S/BB-48TS.

D. Call Station (RACS)

1. POE emergency call device.
2. Provides hands free two-way voice communication.
3. Mushroom head push button call switch with indicating light.
4. Two-gang stainless steel faceplate with permanently silk-screened operator instructions.
5. Manufacturer: Cornell Communications Solutions #4800VS-3.
    a. Include photoluminescent 8”x8” engraved Call Station Instructional Sign.
    b. Manufacturer: Cornell #SN-C48.

PART 3 – EXECUTION

3.1 STORAGE

A. Store Rescue Assistance System components in a cool, dry space prior to installation.

3.2 INSTALLATION

A. General

1. Install in accordance with Code, product listing, and manufacturer's recommendations.
2. All wiring to comply with all National, State, and Local Fire Codes.
3. Exercise particular care in the installation of control rough in boxes to ensure plumb and level placement.
4. Cables:
   a. Four-pair CAT 6 UTP Cable.
   b. All cable runs shall be continuous. **NO SPLICING**
   c. All cables shall be enclosed in conduit.
5. Conduit:
   a. Size per NEC, 1/2" minimum.
6. Terminations:
   a. Connect all devices according to manufacturer's instructions.
   b. Terminate all cables to RJ45 male connectors, T568B wiring scheme.
   c. Identify all cables with location designations.
7. Locate devices as generally shown on Drawings and as specifically indicated on installation instructions. Verify exact locations with the Architect prior to rough-in.
8. Carefully plan cable routes to accommodate length limitations.
   a. Provide RAEX modules as required to extend any cable runs that exceed length limits. Verify RAEX locations with Engineer.
   b. Electrical contractor shall be responsible for additional equipment and cabling costs resulting from exceeded length limits due to conduit routing.
9. Provide 3/4" fire-resistant, plywood backing for RACP and RAEX panels.
   a. Paint all exposed surfaces gray, including edges.
10. Provide 1/2" conduit from RACP to nearest data patch panel or telephone punchdown block, with four-pair CAT 5e or CAT6 UTP cable. Terminate cable in accordance with Owner’s network cabling requirements.
11. Install Call Station Signs adjacent the Call Stations with fasteners. Adhesive mounting not acceptable. Verify exact locations with Architect.
12. Program system with call station location descriptions as per Owner’s convention.
13. Configure system for communication through Owner’s telephone system and program system for Owner’s selected Remote Call Station information.

3.3 TESTING

A. Prior to final inspection, verify that the Rescue Assistance Program system is in proper working condition. Furnish letter of verification to Engineer indicating that the system has been tested. List date of test and names of those in attendance.

B. Notify Owner, Engineer, and local Fire Marshall or Fire Chief one week in advance of scheduled tests. Division 26 Contractor responsible for test coordination and scheduling.

3.4 INSTRUCTIONS

A. Manufacturer's representative to instruct Owner in proper operation, maintenance and testing of the complete Rescue Assistance System. Indicate on letter of verification, name of Owner's representative receiving instructions.

B. Record instructions and include with Record Manuals in accordance with Section 260500.

3.5 CLEANING

A. **Clean** and **vacuum interior** to remove all wire and insulation scraps, dust and dirt.

B. Clean all exposed surfaces immediately prior to final inspection.

END OF SECTION

SECTION 31 1000 – SITE CLEARING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Clearing and protection of vegetation.
   2. Removal of existing debris and site materials as indicated by the Plans.

PART 2 PRODUCTS

2.01 NOT USED

PART 3 EXECUTION

3.01 SITE CLEARING

A. Protect benchmarks, survey control points, and existing site features to remain in place. Damage to these items shall be repaired by the Contractor at no additional expense to the Owner.

B. Ensure all necessary erosion and sediment control measures and permits are in place prior to commencing site clearing.

C. Minimize production of dust due to clearing operations. Do not use water if it will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

D. Clear areas as indicated by the Plans.

E. Apply an approved soil sterilant where existing vegetation is replaced by gravel, concrete, or asphalt.

F. Backfill any voids left from site removals per Specification Section 31 2323 - Fill.

3.02 EXISTING UTILITIES AND AS-BUILT ELEMENTS

A. Coordinate work with utility companies as needed. Notify utility companies before starting work and comply with their requirements. Obtain required permits for Work, if needed.

B. Protect existing utilities to remain from damage.

C. Do not disrupt public utilities without the proper permits from the authority having jurisdiction.

D. Protect existing structures and other elements that are not to be removed.

3.03 VEGETATION

A. Do not remove or damage vegetation that is not shown for removal, or that is outside the property lines.

B. In areas where vegetation must be removed and no subgrade preparation is specified, remove vegetation with minimum disturbance to the subsoil.

C. Dispose of removed vegetation off-site, unless otherwise indicated

E. Remove stumps and roots to a minimum depth of 18-inches below proposed finish grade. Fill holes left by removal of stumps and roots using suitable fill material, with top surface neat in appearance and smooth enough not to constitute a hazard to pedestrians.

F. If vegetation outside the removal limits is damaged or destroyed due to construction operations, replace these items at no cost to the Owner.

3.04 PAVEMENT AND BASE

A. Remove pavement and base in areas as noted by the Plans.

B. Saw a vertical full-depth cut along the proposed removal edge of pavements prior to removal to provide a clean vertical face along the edge of the remaining pavement after removal is complete. Remove concrete pavements to the nearest joint when possible.

C. Take care during removals to avoid damage to adjacent pavements and site features to remain.

D. Remove aggregate base beneath pavement through its full depth, where required.

E. Dispose of removed pavements and base materials off-site, unless otherwise noted.

3.05 DEBRIS

A. Remove debris, junk, and trash from the site.

B. Leave site in clean condition, ready for subsequent work.

C. Clean up spillage and wind-blown debris from the site, and from public and private lands.

END OF SECTION

SECTION 31 2200 - GRADING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Removal and storage of topsoil.
   2. Finish grading.
   3. Topsoil replacement.

B. Reference Reports:
   1. Report of Geotechnical Exploration.

PART 2 PRODUCTS

2.01 MATERIALS

A. Topsoil - Soil Type: Re-use removed topsoil from the site.
   1. Graded and free of clumps larger than 1½-inch in diameter.
   2. Free of roots, rocks larger than ½-inch, subsoil, debris, large weeds, and foreign matter.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that survey benchmarks and intended elevations for the Work are as indicated.

3.02 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Stake and flag locations of known utilities.

C. Locate, identify, and protect from damage above and below grade utilities to remain.

D. Protect site features to remain, including but not limited to, benchmarks, survey control points, existing structures, fences, sidewalks, paving, and curbs from damage.

E. Ensure all erosion and sediment control measures and permits are in place prior to commencing site grading.

3.03 ROUGH GRADING

A. Remove and salvage topsoil thru its full depth from areas to be further excavated, re-landscaped, or re-graded, without mixing it with foreign materials. Stockpile and stabilize an adequate quantity topsoil for re-use after completion of grading.

B. Do not remove topsoil when wet.

C. Remove subsoil from areas to be further excavated, re-landscaped, or re-graded.

D. Do not remove wet subsoil, unless it is subsequently processed to obtain optimum moisture content.

E. Export excess subsoils remaining after completion of grading, or, if additional material is needed to complete site grading, import suitable fill material to meet the proposed site grades.

F. Verify that all soil types and compaction of soils meet the requirements of the Geotechnical Report. If questionable soils are encountered on-site that are not discussed in the Geotechnical Report, contact the Architect immediately to determine what measures should be taken to correct the subgrade issues.

G. When excavating through roots, perform work by hand and cut roots with sharp axe.

3.04 FINISH GRADING

A. Before Finish Grading:
   1. Verify subgrade has been contoured per the Plans.
   2. Verify that compaction and/or soils meet the requirements of the Geotechnical Report.
   3. Verify positive drainage of the subgrade.

B. Slope grade away from building minimum 2-inches in 10-feet, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.

C. Remove debris, roots, branches, stones larger than ½-inch in size. Remove soil contaminated with petroleum products.

D. In areas where vehicles or equipment have compacted soil, scarify surface to depth of 3-inches.

E. Place topsoil during dry weather.

F. Remove roots, weeds, rocks, and foreign material while spreading.

G. Near plants spread topsoil manually to prevent damage.

H. Fine grade topsoil to eliminate uneven areas and low spots. Maintain profiles and contour of subgrade.

I. Lightly compact placed topsoil.

3.05 TOLERANCES

A. Maximum Variation of Surface Flatness: ±½-inch in 10-feet.

3.06 REPAIR AND RESTORATION

A. All exposed soil areas must be stabilized per the North Dakota Pollutant Discharge Elimination System (NDPDES) permit for this site throughout the duration of construction. This may require additional erosion control measures than what is indicated within the Plans. Contractor shall provide all appropriate erosion control measures for their work operations.

B. Existing Facilities, Utilities, and Site Features to Remain: If damaged due to this work, repair or replace to original condition.

3.07 CLEANING

A. Leave site clean and raked, ready to receive landscaping.

END OF SECTION

SECTION 31 2313 – SUBGRADE PREPARATION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Preparing native soil subgrades for placement of aggregate base or pavement.

B. Reference Standards:
   1. North Dakota Department of Transportation (NDDOT) Standard Specifications for Road and Bridge Construction, Current Edition, including applicable Supplemental Specifications published on the date indicated on the Plans.
   2. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
   3. AASHTO T 191 – Density of Soil In-Place by the Sand Cone Method.
   4. ASTM D 2167 – Density and Unit Weight of Soil in Place by the Rubber-Balloon Method.
   5. AASHTO T 310 – In-Place Density and Moisture Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
   6. AASHTO T 265 – Laboratory Determination of Moisture Content of Soils.
   7. ASTM D 4643 – Determination of Moisture Content of Soil by the Microwave Oven Method.

C. Reference Reports:
   1. Report of Geotechnical Exploration.

1.02 SUBMITTALS

A. Results of Standard Soil Proctor for each type of soil encountered that is to be prepared per this section.

B. Compaction Density Test Reports.

PART 2 PRODUCTS

2.01 MATERIALS

A. Verify that all soil types and compaction of soils meet the requirements of the Geotechnical Report. If questionable soils are encountered on-site that are not discussed in the Geotechnical Report, contact the Architect immediately to determine what measures should be taken to correct the subgrade issues. Discontinue affected work in area until notified by Architect in writing to resume work.

PART 3 EXECUTION

3.01 PREPARATION

A. Complete removals, site clearing, and grading to proposed subgrade elevation prior to beginning subgrade preparation.

B. Do not perform work if soils are frozen.

3.02 EXECUTION

A. Scarify soils to a depth as indicated within the geotechnical report using a general-purpose moldboard plow that will completely lift, invert, and throw the soil to the side.

B. Disc the plowed surface to break up and even out the soils.

C. Moisture condition scarified soils to the tolerances indicated by the geotechnical report.

D. Re-compact scarified soils to meet the percent compaction tolerances indicated by the geotechnical report.

E. After re-compaction, perform a proof-roll on the compacted area using a fully loaded dump truck. If there are areas of soft soil or areas where pumping occurs, correct by one of the following methods as approved by the Architect. Architect may direct additional compensation to be made for this work if the Contractor has sufficiently worked the soil in previous subgrade preparation attempts:
   1. Place and compact crushed rock or crushed concrete rubble in this area.
   2. Remove the soft soils and replace with suitable material that shall be moisture conditioned and re-compacted.
   3. Place approved geotextile fabric over the soils.

F. After completion of this work, take care to prevent drying or wetting of these soils that will adversely affect the soil properties. Take appropriate measures to prevent erosion of these soils by wind or water.

3.03 FIELD QUALITY CONTROL

A. Results will be evaluated in relation to compaction curve for each soil type encountered by testing un-compacted material in accordance with ASTM D698 ("standard Proctor"). Density testing shall be performed using the sand-cone method (AASHTO T191), rubber balloon method (ASTM D2167), or nuclear gage method (AASHTO T310). Moisture content shall be obtained by laboratory determination method (AASHTO T265), microwave method (ASTM D4643), or nuclear gage method (AASHTO T310).

B. If tests indicate work does not meet specified requirements, remove work, replace, and retest.

C. Frequency of Compaction Tests: 1 per 2,000 SF of scarified and compacted material.

END OF SECTION

SECTION 31 2316 – EXCAVATION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Excavating for slabs-on-grade, paving, and areas outside of the proposed building footprint.

B. Reference Standards:
   1. North Dakota Department of Transportation (NDDOT) Standard Specifications for Road and Bridge Construction, current edition, including applicable Supplemental Specifications published on the date indicated on the Plans.
   2. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
   3. AASHTO T 191 – Density of Soil In-Place by the Sand Cone Method.
   4. ASTM D 2167 – Density and Unit Weight of Soil in Place by the Rubber-Balloon Method.
   5. AASHTO T 310 – In-Place Density and Moisture Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
   6. AASHTO T 265 – Laboratory Determination of Moisture Content of Soils.
   7. ASTM D 4643 – Determination of Moisture Content of Soil by the Microwave Oven Method.

PART 2 PRODUCTS

2.01 NOT USED

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that survey benchmarks and intended elevations for the work are as indicated.

3.02 PREPARATION

A. Identify required lines, levels, contours, and datum locations.

B. Protect benchmarks, survey control points, existing structures, fences, plant life, sidewalks, paving, and curbs and other features that are to remain from excavating equipment and vehicular traffic.

C. Locate, identify, and protect utilities that are to remain from damage.

3.03 EXCAVATING

A. Excavate to accommodate new structures and construction operations.

B. Notify Architect of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.

C. Slope banks of excavations deeper than 4-feet to angle of repose or less until shored.

D. Do not interfere with 45 degree bearing splay of foundations.

E. Correct areas that are over-excavated and load-bearing surfaces that are disturbed; see Section 31 2323 - Fill.

F. Grade top perimeter of excavation to prevent surface water from draining into excavation.

G. Remove excavated material that is unsuitable for re-use from site.

H. Export excess subsoils remaining after completion of grading.

3.04 FIELD QUALITY CONTROL

A. Provide for visual inspection of load-bearing excavated surfaces before placement of slabs on-grade, paving, or structure.

3.05 PROTECTION

A. Prevent displacement of banks and keep loose soil from falling into excavation; maintain soil stability.

B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

END OF SECTION

SECTION 31 2323 – FILL

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Filling, backfilling, and compacting for slabs-on-grade, and areas outside of the proposed building footprint.

B. Reference Standards:
   1. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 in.) Drop; American Association of State Highway and Transportation Officials.
   2. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
   3. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
   4. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN m/m3)).
   5. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
   6. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
   7. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
   8. North Dakota Department of Transportation (NDDOT) Standard Specifications for Road and Bridge Construction, current edition, including applicable Supplemental Specifications published on the date indicated on the Plans.

1.02 SUBMITTALS

A. Compaction Density Test Reports.

PART 2 PRODUCTS

2.01 FILL MATERIALS

A. General Fill: Subsoil excavated on-site, unless recommended otherwise by the Soils Exploration Report.
   1. Graded.
   2. Free of lumps larger than 3-inches, rocks larger than 2-inches, organic material, and debris.

B. Structural Fill: As defined by the Structural Plans and/or Specifications. Structural fill shall not be required under parking lot areas, unless they are near the building and the geotechnical report requires structural fill around the perimeter of the building.

C. Granular Fill: Base aggregate, conforming to State of North Dakota Department of Transportation Specification Section 816 Class 5 Aggregate Base or section 817 Salvaged Base Coarse standard.

D. Sand: Natural, river or bank sand; washed; free of silt, clay, loam, friable or soluble materials, and organic matter.
   1. Grade in accordance with ASTM D2487 Group Symbol SW.

E. Topsoil - Fill Type: Friable loam; imported borrow if topsoil from site is not adequate.

2.02 SOURCE QUALITY CONTROL

A. If tests indicate materials do not meet specified requirements, change material and retest.

2.03 DELIVERY, STORAGE, AND HANDLING

A. When necessary, store materials on site in advance of need.

B. When fill materials need to be stored on site, locate stockpiles per the following requirements:
   1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
   2. Prevent contamination.
   3. Protect stockpiles from erosion and deterioration of materials.
   4. Do not place stockpiles in standing water or locations where water will drain.
   5. Place in a location that does not adversely affect the work being performed on-site.

PART 3 EXECUTION

3.01 EXAMINATION

A. Identify required lines, levels, contours, and datum locations.

3.02 PREPARATION

A. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.

3.03 FILLING

A. Fill to contours and elevations indicated using unfrozen materials.

B. Fill up to subgrade elevations unless otherwise indicated. If additional material is needed to complete site grading, import suitable fill material to meet the proposed site grades.

C. Employ a placement method that does not disturb or damage other work.

D. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen, or spongy subgrade surfaces.

E. Slope grade away from building minimum 2-inches in 10 ft, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.

F. Place in lifts with a maximum compacted thickness of 8-inches, unless otherwise recommended by the geotechnical report.

G. Maintain moisture during compaction to within the following tolerances attain required compaction density, unless otherwise recommended by the geotechnical report:
   1. Clay: -1% to +3% of optimum moisture content
   2. Sand: ±3% of optimum moisture content

H. Maintain the following minimum compaction densities relative to the soils maximum dry density as determined using the Standard Proctor per ASTM D698, unless otherwise recommended by the geotechnical report:
   1. Under foundations: 98%

2. Under paving, slabs-on-grade, and similar construction: 95%
3. Under landscape surfaces: 90%

I. Reshape and re-compact fills subjected to vehicular traffic.

3.04 TOLERANCES

A. Top Surface of General Filling: ±1/2-inch from required elevations.

3.05 FIELD QUALITY CONTROL

A. Perform compaction density testing on compacted fill in accordance with ASTM D1556, ASTM D2167, ASTM D3017, or ASTM D6938.

B. Evaluate results in relation to compaction curve determined by testing backfill material in accordance with ASTM D698 ("standard Proctor").

C. If tests indicate work does not meet specified requirements, remove work, replace and retest.

D. Frequency of Tests: Each 1-foot lift of every 2,500 sf of compacted area for mass grading, pavement subgrade, and aggregate base course; Each lift for every 100 linear feet of compacted wall backfill.

E. Proof roll compacted fill at surfaces that will be under slabs-on-grade.

3.06 CLEANING

A. Leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

END OF SECTION

SECTION 31 2333 – TRENCHING AND BACKFILLING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Backfilling and compacting for utilities outside of the building footprint to utility main connections.

B. Reference Standards:
   1. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 in.) Drop; American Association of State Highway and Transportation Officials.
   2. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
   3. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
   4. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN m/m3)).
   5. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
   6. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
   7. ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
   8. North Dakota Department of Transportation (NDDOT) Standard Specifications for Road and Bridge Construction, current edition, including applicable Supplemental Specifications published on the date indicated on the Plans.

1.02 SUBMITTALS

A. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used.

B. Compaction Density Test Reports.

PART 2 PRODUCTS

2.01 FILL MATERIALS

A. General Fill - Subsoil that is relatively sandy in texture and easy to compact that is excavated on-site or that is imported.

B. Structural Fill – Subsoil below buildings and foundations and their 1H:1V oversize areas shall be per the Structural Plans and/or Specifications.

C. Granular Fill – Gravel Class 2 per Specification Section 816 of the North Dakota DOT Standard Specifications - AASHTO Ml47, Grade & Sieve as recommended by soils report; with a liquid limit of not more than 25 and a plasticity index of not more than 5 in accordance with ASTM D4318.

D. Sand – Natural, river or bank sand; washed; free of silt, clay, loam, friable or soluble materials, and organic matter.

E. Topsoil – Top layer of soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow.

2.02 SOURCE QUALITY CONTROL

A Where fill materials are specified by reference to a specific standard, test and analyze samples for compliance before delivery to site and obtain Architect's approval of fill material.

B. If tests indicate materials do not meet specified requirements, change material and retest.

C. Provide materials of each type from same source throughout the Work.

2.03 DELIVERY, STORAGE, AND HANDLING

A. When necessary, store materials on site in advance of need.

B. When fill materials need to be stored on site, locate stockpiles per the following requirements:
   1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
   2. Prevent contamination.
   3. Protect stockpiles from erosion and deterioration of materials.
   4. Do not place stockpiles in standing water or locations where water will drain.
   5. Place in a location that does not adversely affect the work being performed on-site.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that survey benchmarks and intended elevations for the work are as indicated.

3.02 PREPARATION

A. Identify required lines, levels, contours, and datum locations.

3.03 TRENCHING

A. Notify Architect of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.

B. Slope banks of excavations deeper than 4-feet to angle of repose or less until shored.

C. Do not interfere with 45° bearing splay of foundations.

D. Cut trenches wide enough to allow inspection of installed utilities.

E. Hand trim excavations. Remove loose matter.

F. Remove large stones and other hard matter that could damage piping or impede consistent backfilling or compaction.

G. Remove excavated material that is unsuitable for re-use from site.

H. Stockpile excavated material to be re-used within the site disturbance limits.

I. Remove excess excavated material from site or waste in designated areas on-site, if applicable.

3.04 PREPARATION FOR UTILITY PLACEMENT

A. Cut out soft areas of sub-grade not capable of compaction in place. Backfill area with granular fill if below utility, and general fill if above utility.

B. Compact sub-grade to density equal to or greater than requirements for subsequent fill material.

C. Until ready to backfill, maintain excavations and prevent loose soil from falling into excavation.

3.05 BACKFILLING

A. Backfill to contours and elevations indicated using unfrozen materials.

B. Employ a placement method that does not disturb or damage other work.

C. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen, or spongy sub-grade surfaces.

D. Place in lifts with a maximum compacted thickness of 8-inches, unless otherwise recommended by the geotechnical report.

E. Maintain moisture during compaction to within the following tolerances attain required compaction density, unless otherwise recommended by the geotechnical report:
   1. Clay: -1% to +3% of optimum moisture content
   2. Sand: ±3% of optimum moisture content

F. Maintain the following minimum compaction densities relative to the soils maximum dry density as determined using the Standard Proctor per ASTM D698, unless otherwise recommended by the geotechnical report:
   1. Under foundations: 98%
   2. Under paving, slabs-on-grade, and similar construction: 95%
   3. Under landscape surfaces: 90%

G. Reshape and re-compact fills subjected to vehicular traffic.

H. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.

3.06 BEDDING AND FILL AT SPECIFIC LOCATIONS

A. Use structural fill below buildings and foundations and their 1H:1V oversize areas

B. Use granular fill for any fill below utilities in utility excavations.

C. Use general fill unless in all other areas, unless otherwise specified or indicated.

3.07 FIELD QUALITY CONTROL

A. Perform compaction density testing on compacted fill in accordance with ASTM D1556, ASTM D2167, ASTM D3017, or ASTM D6938.

B. Evaluate results in relation to compaction curve determined by testing backfill material in accordance with ASTM D698 ("standard Proctor").

C. If tests indicate work does not meet specified requirements, remove work, replace, and retest.

D. Frequency of Tests: Test backfill at 2-foot depth intervals for every 100 linear feet of utility trench.

3.08 CLEANING

A. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

B. Replace topsoil at surface of trench in landscape areas per Section 31 2200 - Grading.

END OF SECTION

SECTION 32 1123 – AGGREGATE BASE COURSE

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Aggregate Base Course for site pavements.

B. Reference Standards:
   1. North Dakota Department of Transportation (NDDOT) Standard Specifications for Road and Bridge Construction, current edition, including applicable Supplemental Specifications published on the date indicated on the Plans.

1.02 SUBMITTALS

A. Results of Aggregate Composition laboratory tests on proposed and actual materials used to verify that they meet all specified requirements.

1.03 DELIVERY, STORAGE, AND HANDLING

A. When necessary, store materials on-site in advance of need.

B. Aggregate Storage, General:
   1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
   2. Prevent contamination.
   3. Protect stockpiles from erosion and deterioration of materials.

PART 2 PRODUCTS

2.01 MATERIALS

A. Class 5 Aggregate Base: Shall meet NDDOT Standard Specification Section 816.01-02 for Class 5 Aggregate.

2.02 SOURCE QUALITY CONTROL

A. Provide materials of each type from same source throughout the Work, unless otherwise approved.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that survey benchmarks and intended elevations for the work are as indicated.

B. Verify substrate has been inspected, gradients and elevations are correct, and is dry.

3.02 PREPARATION

A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting according to Section 31 2313 Subgrade Preparation.

B. Do not place aggregate on soft, muddy, or frozen surfaces.

3.03 PLACEMENT

A. Under Portland Cement Concrete or Bituminous Paving:
   1. Place Class 5 Aggregate Base to a total compacted thickness as specified by the Plans.
   2. Compact aggregate until there is no sign of visible movement under the compacting equipment.

C. Place aggregate in maximum 6-inch layers.

D. Level and contour surfaces to elevations and gradients indicated.

E. Add water to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.

F. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

3.04 FIELD QUALITY CONTROL

A. If work does not meet specified requirements, remove work, replace, and retest.

3.05 CLEANING

A. Remove unused stockpiled materials and leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

END OF SECTION

SECTION 32 1313 – CONCRETE PAVING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Concrete parking lot, sidewalks, curbs, gutters, valley gutters, and driveways.

B. Reference Standards:
   1. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; American Concrete Institute International; 1991 (Reapproved 2002).
   2. ACI 301 - Specifications for Structural Concrete for Buildings; American Concrete Institute International; 2010.
   3. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; American Concrete Institute International; 2000.
   4. ACI 305R - Hot Weather Concreting; American Concrete Institute International; 2010.
   5. ACI 306R - Cold Weather Concreting; American Concrete Institute International; 2010.
   6. ASTM A185/A185M - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
   7. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
   8. ASTM C33/C33M - Standard Specification for Concrete Aggregates.
   9. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
   10. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
   11. ASTM C150/C150M - Standard Specification for Portland Cement.
   12. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
   13. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
   14. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
   15. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.
   16. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
   17. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (nonextruding and Resilient Bituminous Types).
   18. ASTM D1752 - Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
   19. North Dakota Department of Transportation (NDDOT) Standard Specifications for Road and Bridge Construction, current edition, including applicable Supplemental Specifications published on the date indicated on the Plans.

1.02 SUBMITTALS

A. Provide a concrete mix design prepared by an independent testing laboratory.

B. Provide manufacturers' product data.

C. If requested by Architect, provide written explanation from Ready-Mix Supplier as to how concrete will be delivered and what, if any, special measures will be required.

D. A meeting with the contractor, ready-mix supplier, testing firm and Architect in attendance, is required. The meeting shall be held a minimum of 10-day prior to the beginning of construction. Topics to be addressed will include mix design, specifications, expectations, delivery communications, and testing requirements.

E. Prior to pouring concrete in cold weather, a written request outlining the use of accelerating admixture shall be submitted to the Architect for approval.

F. Prior to pouring concrete in hot weather, a written request outlining the use of set retarding admixture shall be submitted to the Architect for approval.

1.03 QUALITY ASSURANCE

A. Acquire cement and aggregate from same source for all work.

B. Provide written documentation for cement, listing manufacturer, and certifying that cement meets specifications.

C. Concrete shall not be poured when the air temperature may fall below 35° F during the pouring or within 24-hours unless preparations are made and precautions taken to prevent any damage to the concrete from the low temperature as approved by the Architect.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver and place concrete in a manner that provides minimum segregation.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Avoid over spraying with curing compound.

B. Properly dispose of all excess curing compound.

C. Utilize appropriate protection against inclement weather.

D. Designate concrete wash area that all trucks delivering concrete to the site shall use. Area must not impact public property, watercourses, water bodies, or wetlands.

PART 2 PRODUCTS

2.01 FORM MATERIALS

A. Form Materials: Conform to ACI 301.

2.02 CEMENT

A. Cement shall be an approved and established brand of Portland Cement Type I, Type IL, Type IA or Type II. Different brands of cement, or the same brand of cement from different mills, shall not be mixed during use without permission from the Architect.

B. Cement shall be stored in a suitable manner to prevent moisture damage; cement which is partially set or which contains lumps or cakes shall be rejected.

C. The vendor shall provide backup documentation and certifications that the cement used meets these requirements.

2.03 FLYASH

A. Fly Ash shall be Class F and meet requirements of AASHTO M-295 for Portland Cement Concrete.

B. Fly Ash will be allowed as a cement replacement on a 1:1 ratio, up to a maximum of 29% by weight. Fly ash content of mixes will be reduced to a maximum of 15% replacement of cement in cold weather concrete conditions. Cold weather exists when the air temperature has fallen to or is expected to fall below 40°F (4°C) during the protection period, which is defined as the time required to prevent concrete from being affected by exposure to cold weather. High-Early Strength concrete mixes may include up to 15% direct replacement of cement with fly ash.

2.04 AGGREGATES

A. Aggregate mixes shall meet the requirements of NDDOT Standard Specification Section 802.01 C.

2.05 WATER

A. Water for concrete shall be clean and free from oil, acid, alkali, and vegetable substances. Water from non-potable sources shall be tested according to AASHTO T-26.

2.06 ADMIXTURES

A. Air Entrainment
   1. Air entrainment admixture or air entrained cement is to be used. Entrained air content shall be targeted for 6% and will be between 5% and 8% as measured at the point of placement.

B. Chemical Entrainment
   1. Chemical admixtures shall conform to AASHTO M194.

C. Color Additives
   1. Color additives shall conform to ASTM C979, be resistant to lime and other alkali, and be resistant to sunlight. Color additives shall be mixed per the manufacturer's recommendations and until additives are uniformly dispersed throughout the mix. Dosage rate of admixtures shall not exceed 10% of weight of cementitious materials in the mix. Color shall be approved by the Architect prior to finalizing the mix design.

2.07 JOINT MATERIAL

A. Expansion Joints
   1. If expansion or isolation joints are required, they shall be as indicated in the drawings or details. Joint material thickness will be as specified and/or approved, or per manufacturer's recommendation. It shall extend the full width of the pavement slab and curb, and any concrete at the ends when the forms are removed shall be chipped away. The dowel support, where required, shall securely and rigidly hold the dowel bars and pre-molded filler in correct position during the paving operation. All expansion/isolation joint faces shall be cleaned and sealed with silicone sealant or equal to produce a slightly concave surface ¼ inch below the concrete surface.
   2. The entire expansion joint assembly shall be of a type approved by the Architect.

B. Poured Joint Filler may be polymeric or silicone.
   1. Polymeric Sealant: The material for filling poured expansion and contraction joints and cracks shall be hot poured elastic type and shall conform to the requirements of ASTM D-1190. The material shall be composed of a homogeneous blend of virgin polymers, plasticizers, special fillers and

asphalt compounded specifically for the sealing of cracks in asphalt or concrete pavement. Ground cured rubber scrap shall not be used.

2. Silicone Joint Sealant: The Silicone sealant shall be a Low Modulus Silicone Sealant meeting the requirements of the 2008 NDDOT Specifications Section 826.02.B.1. Self-leveling silicone sealants will not be allowed.

2.08 CURING COMPOUNTS

A. All curing compounds shall be applied in accordance with the manufacturer's recommendations.

B. Parking Lot, Driveway, and Sidewalk Paving
   1. White pigmented liquid curing compound conforming to the requirements of AASHTO M148 Type 2, Class B or AASHTO M 148 Type 2.

C. Separate Curb and Gutter
   1. White pigmented liquid curing compound conforming to the requirements of AASHTO M148 Type 2.

2.09 MIX REQUIREMENTS

A. A mix design shall be provided to the approved Architect a minimum of 48-hours before pouring. Any revisions to the mix design must be approved by the Architect.

B. One cubic yard of mixed concrete in place shall contain not less than 564 lbs. minimum of cementitious materials.

C. The water-cement ratio shall not exceed 0.45.

D. The slump shall not exceed four (4) inches for formed paving, or two (2) inches for slip-form paving.

E. 28-day compressive strength shall meet 4000 psi for standard concrete

F. Entrained air content shall be targeted for 6% and will be between 5% and 8%.

2.10 HIGH-EARLY STRENGTH CONCRETE

A. High-early strength concrete may be obtained by the following method:
   1. When Type I, Type IL, Type IA, or Type II cement is used, the cement content shall be increased to 7.2 sacks of cement per cubic yard (676 pounds). No flyash is allowed. Water-cement ratios will be shown in NDDOT Table 802.01B.1 for the class of concrete shown.
   2. The use of non-chloride accelerators for high-early strength concrete is allowed.

B. The use of hydration stabilizers to preserve workability of high-early strength concrete in route to the project is allowed.

C. High-early strength concrete shall be used when specified in the Contract Documents.

D. When the Contractor requests and obtains permission from Architect to use high-early strength concrete. No additional payment will be made for any extra costs incurred in producing and placing the high-early strength concrete.

E. Contractor shall provide environment to ensure that high-early strength concrete mixes will attain field strength of 3000 psi compressive strength prior to opening to public traffic. At no time may concrete

exceed 90°F in temperature while under blankets or other protection devices, nor fall below 60°F during the 24-hour period.

2.11 MIXING AND TRANSPORTING CONCRETE

A. Procedures shall conform to NDDOT Section 155.03 and 155.04.

2.12 AUXILIARY FINISHING EQUIPMENT AND MATERIAL

A. Straight Edge
   1. Two or more ten (10) foot straight edges of an approved type shall be used. Extra blades shall be provided and used when previously used edges become wavy and warped.

B. Floats
   1. Approved long handled floats, each having a blade at least 0.5-feet in length and 6-inches in width.

C. Master Straight Edge
   1. All straight edges shall be tested by the master straight edge before being used and shall be tested frequently during their use.

D. Final Surface Finish
   1. The final surface and the concrete pavement shall have a uniform gritty texture, free from excessive harshness and true to the graded and cross sections shown on the plans.
   2. Before brooming or burlap dragging is complete, and before the concrete has taken its initial set, the edges of the slab shall be carefully finished with an edger having a ¼" radius.

2.13 REINFORCEMENT

A. Reinforcing Steel: ASTM A615/A615M Grade 60 deformed billet steel bars; unfinished.

B. Steel Welded Wire Reinforcement: Plain type, ASTM A185/A185M; in flat sheets; unfinished.

C. Tie Bars: ASTM A615/A615M Grade 60; deformed billet steel bars; unfinished.

D. Dowel Bars: ASTM A615/A615M Grade 60, smooth steel bars, unfinished; or ¼" thick Diamond Dowels®; or approved equal.

PART 3 CONSTRUCTION

3.01 EXAMINATION

A. Verify compacted sub-grade and/or sub-base are acceptable and ready to support paving and imposed loads.

B. Verify gradients and elevations of base are correct.

3.02 PREPARATION

A. Moisten base to minimize absorption of water from fresh concrete.

B. Notify Architect minimum 24-hours prior to commencement of concreting operations.

3.03 FORMING

A. Place and secure forms to correct location, dimension, profile, and gradient.

B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.

C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

3.04 REINFORCEMENT

A. When required, place rebar reinforcement 2-inches from top of slabs-on-grade and a minimum of 2-inches from slab edges.

B. Interrupt continuous reinforcement at expansion/isolation joints.

C. Place dowels to achieve pavement and curb alignment as detailed.

3.05 COLD WEATHER POURING

A. Prior to pouring in cold weather, a written request must be made and approved by the Architect. Any concrete damaged by freezing shall be replaced by the Contractor at his own expense. Temperature of the concrete when deposited in the forms shall be between 60° and 90°F and maintained at a minimum temperature of 40°F for at least 5 days after placing, or until the concrete attains a compressive strength of 3000 psi. Concrete shall not be place on a frozen subgrade or base. Any part of pavement damaged from traffic or other causes occurring prior to the acceptance of the pavement shall be repaired to the satisfaction of the Architect at the Contractor's expense.

B. Admixtures for curing or temperature control shall be used only as permitted or directed by the Architect. The admixtures shall not be considered as a substitute for any specified curing requirement.

3.06 JOINTS AND SAWING

A. Joints in concrete pavement shall be of the design specified and shall be constructed at the spacing shown on the plans. The contractor shall establish the joint locations in the field from the plans or standard details. All joints shall be sawed along a true and straight line established by the Contractor and shall not deviate at any point by more than ½-inch from the established line.

3.07 CONTRACTION JOINTS AND SAWING

A. The location of each contraction joint shall be marked in a manner satisfactory to the Architect, prior to placement of the concrete and, in the case of joints that are to be sawed. The markings shall be transferred to the fresh concrete as soon as the final finishing operations have been completed. All contraction joints shall be sawed to a sufficient depth to control cracking, but in no case to a depth less than ¼ of the thickness of the pavement. Joints constructed in the pavement shall be sawcut through the integral or separate curb. The Contractor shall be responsible for sawing to a depth that will prevent uncontrolled cracking. A sufficient number of saw cuts shall be made as soon as possible to relieve the contraction joint tension in the slab. Remaining saw cuts must be made within 24-hours after pouring.

B. The initial sawing shall be accomplished as soon as the condition of the concrete will permit without raveling and before random cracking occurs. The sequence of initial sawing shall be at the Contractor's option. The sawing shall be immediately delayed if any raveling occurs. Water under nozzle pressure shall be used to remove the sawing residue from each joint and the pavement surface immediately after completing the sawing of that joint. Widening the joints to full width as per dimensions shown on

the jointing/sealing detail shall not be performed until the concrete has cured for at least 24-hours and shall be delayed longer when the sawing causes joint raveling.

C. The early entry dry saw "Soft Cut" method of sawing will only be allowed with the Architects approval for the initial saw cutting. If uncontrolled cracking occurs, removal and replacement of damaged concrete will be at the Contractor's expense. Concrete is to be removed at the nearest planned joint. The removal and replacement method shall be approved by the Architect.

3.08 EXPANSION JOINTS

A. Expansion joints shall be spaced as shown on the plans and shall be of the preformed type and shall extend entirely through the depth and width of the pavement and through all integral curbs. No concrete shall be left above the expansion material or across the joint but shall be cut away after the forms are removed.

B. The expansion material and dowel assembly, where required, shall be accurately and firmly staked to the subgrade. The top edge of the filler shall be set 2-inches below the pavement surface. During the placing of the concrete, the top edge of the filler shall be protected by a removable channel cap. After the concrete has been placed and finished, the cap shall be removed and the joint edged to the specified radius. All expansion/isolation joints shall be cleaned and sealed with silicone sealant to produce a slightly concave surface approximately ¼-inch below the concrete surface.

C. Before the pavement is opened to permanent traffic, the joint shall be cleaned so that there is a clear space of the specified width for the full depth and width of the pavement. It shall then be filled with joint filler which, when cooled, shall be ¼-inch below the surface of the pavement. Any sealant material on the surface of the pavement shall be removed at the Contractor's expense.

3.09 CONSTRUCTION JOINTS

A. Construction joints shall be constructed at the end of each day and whenever the placing of the concrete is suspended for more than 45 minutes. When the work is suspended near the proper location for an expansion joint, the expansion joint shall be installed in the manner previously specified, except that the concrete shall only be placed on one side of the header. When work is resumed, it shall be placed on the other side.

B. When work is suspended at other locations, a contraction joint shall be formed by securely staking in place, at right angles to the subgrade and centerline of the pavement, a bulkhead of wood or metal cut to the cross section of the pavement and then depositing concrete against it. Before the work is resumed, the bulkhead shall be removed and concrete placed against the face of the older concrete.

C. Construction joints shall only be constructed at planned joint locations.

D. Dowel bars shall be installed for load transfer across the joint if specified by the plans. The dowel bars shall be either installed with the construction joint or later drilled in place. If installed with construction joint they shall be held in place midway across the joint, parallel to both the surface and the centerline of the slab by a dowel splicer basket assembly, self-supported dowel sleeve, or other supporting device approved by the Architect. The dowel bars shall be installed within the tolerances specified above for placing reinforcement. One end of the dowel shall be painted or coated with an approved lubricant.

3.10 PAVEMENT FINISHING

A. Strike-off and compaction shall be done by both vibration and screed processes. Separate power machines may be used for each process or both processes may be combined in the same machine, provided controls exist enabling the operator to apply either operation separately or both combined.

B. When weather conditions cause rapid drying of the pavement surface a fine mist or fog spray applied to the concrete surface shall be permitted only if approved by the Architect. Using any other method to apply water to the concrete surface will not be permitted and will result in non-payment, replacement, and/or repair of the wetted area as determined by the Architect.

C. Forms shall be left in place for at least 12-hours after placing the concrete, and the method of removing them shall not damage or mar the concrete.

D. The finished surface of the pavement must conform to the grade, alignment, and contour shown on the plans. Immediately following the floating operation, the Contractor shall test the slab surface for trueness with a 10-foot straight edge. The straightedge shall be placed parallel to the pavement centerline and passed over the slab to reveal any high areas or depressions. The high areas or depressions shall be cut or filled as necessary with the long-handled floats and the area checked again with the straight edge. Successive advances of the straight edge shall overlap by ½ the length of the straightedge. The entire surface shall be checked until all variations in excess of ¼" in 10' have been eliminated. Special care shall be taken at all headers to ensure this variation is held to a minimum.

3.11 CURB FINISHING

A. Curb and Gutter shall be constructed using a slip-form machine or fixed forms. Fixed forms shall be full depth.

B. No grout shall be used to finish the face of the curb. After the concrete is poured into the forms, it shall be puddled, vibrated and spaded so as to ensure a thorough, dense mixture, eliminate air pockets, and create uniform and smooth sides. Any honeycombing voids, or exposed aggregate on the back of the curb shall be grouted.

C. When weather conditions cause rapid drying of the pavement surface, a fine mist or fog spray applied to the concrete surface shall be permitted only if approved by the Architect. Using any other method to apply water to the concrete surface will not be permitted and will result in non-payment, replacement, and/or repair of the wetted area as determined by the Architect.

D. Before the curb concrete has thoroughly set, and while the concrete is still green, the forms shall be removed and the front and top side finished with a float or steel trowel to make a uniform finished surface.
   1. Rounding Corners
      a. Whenever corners are to be rounded, special steel trowels shall be used while the concrete is still workable and the corners constructed to the dimensions herein specified. For combined curb and gutter, the top and side of the curb and gutter may be finished by means of a special shaped trowel or by a curb and gutter machine which spaces the entire surface in accordance with the specified dimensions. This trowel shall be used immediately upon removing the front form while the concrete is still workable but firm enough to stand up.
   2. Smoothness
      a. The top and face of the curb and also the top of the apron on combined curb and gutter must be finished true to line and grade without any irregularities of surface noticeable to the eye. No portion of the surface or face of the curb or gutter section shall depart for more than ¼-inch from a straight edge 10-feet in length, placed on the curb parallel to the center line of the street, nor shall any part of the exposed surface present a wavy appearance.

E. All joints shall be formed and placed at the specified intervals. When constructed adjacent to concrete pavement, joints shall match the pavement joints. Joint sealing shall be as specified.

F. Concrete shall cure for 72-hours. All surfaces not protected by forms during this period shall be covered with a curing compound.

3.12 PAVEMENT FINAL SURFACE FINISH

A. The edges of the pavement shall be left smooth and true to line and finished at about the time and concrete takes its initial set.

B. After surface irregularities have been removed and before the concrete attains an initial set, the pavement shall be uniformly textured using a seamless strip of artificial grass, burlap, or brooming.

C. In case that an extruding paving machine is used, the texturing material being pulled longitudinally shall be mounted to a self-propelled bridge, operated off the paving string line, and shall not deviate at any point by more than ½-inch from the established alignment.

D. Formed paving brooms shall be drawn across the surface at right angles to the centerline of the pavement, with the stroke of the broom slightly overlapping adjacent strokes. The brooming operation shall apply a uniform texture with 1/16-to-1/8-inch deep striations. Brooms shall be washed and dried at frequent intervals during the day. Any long or coarse bristles that my cause surface irregularities shall be trimmed or cut out, and any brooms that have become worn out shall be discarded.

E. Upon completion of the final finishing the surface texture shall be uniform in appearance and free of surface water, rough or porous spots, irregularities, depressions, and other objectionable features.

F. For pavement in the public right-of-way, the Contractor shall mark in each 3,000 square feet of pavement, every 100 LF for continuous pours of new curb and gutter and/or sidewalk, at each end of property lines, every curb and gutter and/or sidewalk patch done per lot and each driveway by stamping the Contractor's name, address and year in which the pavement was constructed. The stamped letter should be 1-inch high and ¼-inch deep. Contractor's stamp must be approved by the Architect prior to the beginning of construction. Contractor shall be responsible for changing the date on the stamp each year.

3.13 CURING AND PROTECTION

A. Normal Pavement: As soon as the concrete has been textured, the Contractor shall start curing operations. The finished surface shall be sprayed with an approved curing agent on all exposed faces. Sufficient curing compound shall be applied at a rate of approximately 200 SF/gal to ensure a coating as white as a sheet of paper. In lieu of curing agent, the concrete may be cured by wet burlap or other methods approved by the Architect. When wet burlap or plastic film is used for curing, the curing period shall be at least 5 days. The concrete surface must not be pitted from or damaged from application of water or incidental rain. The Contractor shall protect all concrete from weather conditions, traffic damage, or any other causes occurring prior to its final acceptance. Any damaged section shall be repaired at the Contractor's expense.

B. Colored Pavement: Colored pavement shall be cured with an approved clear curing compound generally defined as a dissipating cure or a wax based cure matching the color of the decorative concrete. Curing procedures should generally follow the guidelines of the color admixture supplier for the concrete in the pavement.

C. Timing of Curing Compound Application: Curing procedures should be undertaken within ½-hour of completion of finishing operations or before the wet sheen on the surface or the concrete disappears, whichever occurs first. Evaporation retarders shall be used for interim protection whenever hot, windy or dry conditions quantified by evaporation rates exceeding 0.2 pounds per square foot per hour exist

and shall be used in accordance with manufacturer's recommendations. Evaporation retarders shall not be used as a finishing aid.

3.14 JOINT FILLING AND SEALING

A. Joints shall be filled within 10-days after placement and before opening pavement to traffic.

B. All vertical joint faces shall be cleaned. Oil, asphalt, curing compound, paint, rust, and other foreign materials shall be completely removed. Just before the joints are sealed, the Contractor shall clean the joints with compressed air at a working pressure of at least 90 psi. The joints shall not be sealed when the air temperature is below 40° F.

C. Backer rod shall be used in silicone sealed joints to control the depth of the filler/sealer material. Rod backer is not required on hot pours to achieve the desired shape of the material and support the material against indentation and sag. The backer rod shall be compatible with the filler/sealer and not subject to the absorption of water. Clean all surfaces of excess filler and sealant.

D. Contraction/Construction joints constructed in the pavement shall be widened and sealed through the integral or separate curb.
   1. Hot Pour Sealant.
      a. The joint filler shall be forced into the joint with a pressure type applicator capable of filling the joint from the bottom up to a height approximately ¼-inch below the pavement surface, without any overflow or spillage onto the pavement surface. Clean all surfaces of excess sealant.
   2. Silicone Sealant
      a. Silicone joint sealer may be used in lieu of hot pour elastic filler. The sealant shall be tooled to produce a slightly concave surface approximately ¼-inch below the pavement surface. Self-leveling sealant will not be allowed.

3.15 PROTECTION OF PAVEMENT

A. This procedure shall conform to Section 550.04 N. of the 2008 NDDOT Specifications

3.16 LOCATION OF EXISTING UTILITIES

A. Existing manholes, gate valves, and stop boxes have been shown to direct the Contractor's attention to their existence. The Contractor is cautioned that not all utilities have been shown and their location is not guaranteed. The Contractor is responsible for determining the exact location of existing utilities that affect the installation of the paving.

3.17 TOLERANCES

A. Maximum Variation of Surface Flatness: ±¼-inch in 10-feet.

B. Maximum Variation from True Position: ±¼-inch.

3.18 FIELD QUALITY CONTROL

A. Contractor shall provide a testing firm to complete fresh concrete and compression testing as required herein.

B. When casting cylinders, provide the following:
   1. Field Cure - as required to determine when pavement can be opened to traffic
   2. 2 - 7 Day (lab cured)

3. 2 - 28 Day (lab cured)
4. 2 - Extras

C. Testing is required at 100 cubic yard intervals for pours that exceed 100 cubic yards. For pours that are less than 100 cubic yards, testing will be done on every pour. A Field Technician will be required to obtain batch tickets from the delivery driver on every test cylinder that is to be tested. A Field Technician shall complete slump and air testing at the project location. Concrete test specimens for compression strength tests will be made and cured according to accepted ASTM procedures.

D. The Testing Firms shall comply with ACI 318 in regards to supplying Architect, Contractors, concrete suppliers and other designated individuals with notification of concrete field test results such as slump, water content and air content immediately, and compression strength test results within 48-hours after test completion.

3.19 OPENING TO TRAFFIC

A. Newly constructed pavement shall not be opened to public traffic until all joints are sealed and the concrete has attained a flexural strength of 450 psi or a compressive strength of 3,000 psi, as determined by breaking test cylinders cured in the field in a manner that replicates as closely as possible the curing conditions of the pavement. The Contractor shall erect and maintain suitable barricades and lights to protect the pavement from traffic. Any part of the pavement damaged from traffic or other causes occurring prior to the acceptance of the pavement shall be repaired to the satisfaction of the Architect at the Contractor's expense.

END OF SECTION

SECTION 32 1723 – PAVEMENT MARKING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Parking lot markings, including parking bays, crosswalks, arrows, handicapped symbols, and curb markings.

B. Reference Standards:
   1. MPI (APL) – Master Painters Institute Approved Products List; Master Painters and Decorators Association; current edition, www.paintinfo.com.
   2. FHWA MUTCD – Manual of Uniform Traffic Control Devices for Streets and Highways; U.S. Department of Transportation, Federal Highway Administration; http://mutcd.fhwa.dot.gov; current edition.

1.02 SUBMITTALS

A. Submit manufacturer's data sheet for each product to be used that includes, at a minimum, the following information:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Deliver paint in containers of at least 5 gallons accompanied by batch certificate.

B. Store products per manufacturer's recommendations in manufacturer's unopened packaging until ready for installation.

C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.04 FIELD CONDITIONS

A. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.01 MATERIALS

A. Line and Zone Marking Paint: MPI No. 32 Traffic Marking Paint; color(s) as indicated.
   1. Parking Lots: White or Yellow.
   2. Handicapped Symbols and Parking Spaces: Blue.

B. Temporary Marking Tape: Preformed, reflective, pressure sensitive adhesive tape in color(s) required; Contractor is responsible for selection of material of sufficient durability as to perform satisfactorily during period for which its use is required.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Allow new pavement surfaces to cure for a period of not less than 14 days before application of marking materials.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Clean surfaces thoroughly prior to installation. Remove dust, dirt, and other granular surface deposits by sweeping, blowing with compressed air, rinsing with water, or a combination of these methods.

D. Where oil or grease are present, scrub affected areas with several applications of trisodium phosphate solution or other approved detergent or degreaser, and rinse thoroughly after each application. After cleaning, seal oil-soaked areas with cut shellac to prevent bleeding through the new paint.

E. Establish survey control points to determine locations and dimensions of markings. Provide templates to control paint application by type and color at necessary intervals.

F. When required, apply temporary markings of the color(s), width(s), and length(s) as indicated or directed.
   1. After temporary marking has served its purpose, remove temporary marking by carefully controlled sandblasting, approved grinding equipment, or other approved method so that surface to which the marking was applied will not be damaged.
   2. At Contractor's option, temporary marking tape may be used in lieu of temporary painted marking. Remove unsatisfactory tape and replace with painted markings at no additional cost to the Owner.

3.03 INSTALLATION

A. Begin pavement marking as soon as practicable after surface has been cleaned and dried.

B. Do not apply paint if temperature of surface to be painted or the atmosphere is less than 50° F or more than 95° F, or per the manufacturer’s recommendations. Follow the more stringent requirement for application.

C. Apply in accordance with manufacturer's instructions using an experienced technician that is thoroughly familiar with equipment, materials, and marking layouts.

D. Comply with FHWA MUTCD manual (http://mutcd.fhwa.dot.gov) for details not shown.

E. Apply markings in locations determined by measurement from survey control points.

F. Apply uniformly painted markings of color(s), lengths, and widths as indicated on the drawings with true, sharp edges and ends.
   1. Apply paint in one coat only.

2. Wet Film Thickness: 0.015-inch, minimum.
3. Width Tolerance: ±1/8-inch.

G. Parking Lots: Apply parking space lines, entrance and exit arrows, painted curbs, and other markings indicated on drawings.
1. Mark the International Handicapped Symbol at indicated parking spaces.
2. Hand application by pneumatic spray is acceptable.

H. Symbols: Use a suitable template that will provide a pavement marking with true, sharp edges and ends, of the design and size indicated.

3.04 DRYING, PROTECTION, AND REPLACEMENT

A. Protect newly painted markings so that paint is not picked up by tires, smeared, or tracked.

B. Provide barricades, warning signs, and flags as necessary to prevent traffic crossing newly painted markings.

C. Allow paint to dry at least the minimum time specified by the applicable paint standard and not less than that recommended by the manufacturer.

D. Remove and replace markings that are applied at less than minimum material rates, deviate from true alignment, exceed length and width tolerances, or show light spots, smears, or other deficiencies or irregularities.

E. Remove markings in manner to avoid damage to the surface to which the marking was applied, using carefully controlled sand blasting, approved grinding equipment, or other approved method.

F. Remove and replace unacceptable markings at no additional cost to Owner.

END OF SECTION

SECTION 32 8423 - UNDERGROUND SPRINKLERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe and fittings, valves, sprinkler heads, emitters, bubblers, and accessories.

1.02 RELATED REQUIREMENTS

A. Section 31 2316 - Excavation: Excavating for irrigation piping.

B. Section 31 2323 - Fill: Backfilling for irrigation piping.

1.03 REFERENCE STANDARDS

A. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.

B. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the work with site backfilling, landscape grading and delivery of plant life.

B. Preinstallation Meeting: Convene one week prior to commencing work of this Section.

1.05 SUBMITTALS

A. Product Data: Provide component and control system and wiring diagrams.
   1. Water regulators.
   2. Water hammer arresters.
   3. General-duty valves.
   4. Control-valve boxes.
   5. Sprinklers.
   6. Controllers, include wiring diagrams.
   7. Control cables, include splice kits.
   8. Backflow preventer.

B. Shop Drawings: Indicate piping layout to water source, irrigation system piping (locations, types, sizes, capacities, and flow characteristics), location of sleeves under pavement, location and coverage of sprinkler heads, components (water meters, backflow preventers, valves, piping, sprinklers and devices, controls), plant and landscaping features, site structures, schedule of fittings to be used. Show wire size and number of conductors for each control cable.

C. Operation and Maintenance Data:
   1. Provide instructions for operation and maintenance of system and controls, seasonal activation and shutdown, and manufacturer's parts catalog.
   2. Provide schedule indicating length of time each valve is required to be open to provide a determined amount of water.

D. Maintenance Materials: Provide the following for Owner's use in maintenance of project.
   1. Extra Sprinkler Heads: One of each type and size.

2. Extra Valve Keys for Manual Valves: One.
3. Extra Valve Box Keys: One.
4. Extra Valve Marker Keys: One.
5. Wrenches: One for each type head core and for removing and installing each type head.

1.06 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 three years of experience.

1.07 REGULATORY REQUIREMENTS

A. Conform to applicable code for piping and component requirements.

1.08 DEFINITIONS

A. Circuit Piping: Downstream from control valves to sprinklers, specialties, and drain valves. Piping is under pressure during flow.

B. Drain Piping: Downstream from the circuit-piping drain valves. Piping is not under pressure.

C. Irrigation Main Piping: Downstream from point of connection to water distribution piping to, and including, control valves. Piping is under water-distribution-system pressure.

D. The following industry abbreviations for plastic Materials:
1. ABS: Acrylonitrile-butadiene-styrene.
2. FRP: Fiberglass-reinforced plastic.
3. PA: Polyamide (nylon) plastic.
4. PE: Polyethylene plastic.
5. PP: polypropylene plastic.
6. PTFE: Polytetrafluoroethylene plastic.
7. PVC: Polyvinyl Chlorine plastic.
8. TFE: Tetrafluoroethylene plastic.

1.09 PERFORMANCE REQUIREMENTS

A. Design head-to-head water-coverage irrigation system for lawns and exterior plants indicated.

B. Location of Sprinklers and Specialties: Make minor adjustments necessary to avoid plantings and obstructions such as signs and light standards. Maintain 100 percent water coverage of turn and planting areas indicated.

C. Provide necessary components to properly winterize the irrigation system.

D. Minimum Working Pressures: The following are minimum pressure requirements for piping, valves, and specialties, unless otherwise indicated.
1. Irrigation Main Piping: 200 psig
2. Circuit Piping: 100 psig
3. Drain Piping: 100 psig

E. Maximum Run Time: All zones shall be run within an 8-hour time frame.

F. All turf areas shall be on separate zone from planting beds.

PART 2 PRODUCTS

2.01 IRRIGATION SYSTEM

A. Manufacturers:
   1. Rain Bird Sales, Inc: www.rainbird.com.
   2. Toro Company: www.toro.com.
   3. Weathermatic: www.weathermatic.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PIPES, TUBES, AND FITTINGS

A. Mainline: Class 200 PVC continuously marked with manufacturer's name, class, and size.

B. Lateral lines not under constant pressure: Flexible, 4710, non-toxic, polyethylene pipe rated for 100 psi minimum working pressure..

C. Sleeves: Class CL160 PVC.
   1. Place under all concrete or asphalt paving where irrigation lines must be installed.
   2. Sleeve shall be twice the nominal size of the pipe being installed.
   3. Provide a separate 1-1/4 inch sleeve for irrigation wiring.

2.03 GENERAL-DUTY VALVES

A. Electronic valves shall be compatible with the irrigation controller.

B. Electronic valves shall have an electronic solenoid that is normally open.

C. Electronic valves shall be buried underground in a valve box with a cover.

2.04 SPRINKLERS

A. Sprinkler heads shall be fully adjustable that will provide uniform coverage over designated watering area.

B. Rotary heads shall not have pop up spray heads on the same zone unless they are equipped with a rotary nozzle.

C. Pop up spray heads shall be a minimum of 4-inches in height.

2.05 COMMUNICATIONS CIRCUITRY

A. Electric control lines from each controller to the automatic valve shall be direct burial wire. Minimum size - #18. Connection shall be installed using blazing BVS1 or BVS2 connectors and be waterproof.

B. All wire splicing shall be in a valve box.

2.06 AUTOMATIC – CONTROL SYSTEM

A. Provide and install an automatic controller that has a visible readout display that is compatible with a rain shut off device. It must be able to have multiple programs and multiple start times.

B. It must be programmable for 7 days of watering and a custom watering schedule with an automatic start and shutdown.

C. See Architectural Plans for proposed control system location in the building.

2.07 WATER METER

A. Meter type and manufacturer shall be in accordance with Water Department requirements. If meter is furnished and installed by Water Department make all arrangements with Water Department for meter installation. Remote readout shall be provided if required by Water Department.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that required utilities are available, in proper location, and ready for use.

3.02 PREPARATION

A. Piping layout indicated is diagrammatic only. Route piping to avoid plants, ground cover, and structures.

B. Layout and stake locations of system components.

C. Review layout requirements with other affected work. Coordinate locations of sleeves under paving to accommodate system.

3.03 TRENCHING

A. Trench and backfill in accordance with Section 31 2316 and Section 31 2323.

B. Trench to accommodate grade changes and slope to drains.

C. Maintain trenches free of debris, material, or obstructions that may damage pipe.

3.04 INSTALLATION

A. Install pipe, valves, controls, and outlets in accordance with manufacturer's instructions.

B. Mainline pipe which is under constant pressure, shall be installed with a minimum depth of cover of 18-inches. Other pipe shall be installed with a minimum cover of 12-inches.

C. Piping shall be securely capped at the end of each day's work to prevent entrance of foreign material.

D. Set outlets and box covers at finish grade elevations.

E. Provide for thermal movement of components in system.

F. Wiring shall be installed with main line piping in the same trench. At each connection to the valve 2' slack shall be provided to facilitate future service. Underground splices shall be waterproofed with the wire connectors and direct bury splice kit (3M DBY) as manufactured by 3M company.

G. Install control tubing in accordance with manufacturer's instructions. Provide 10-inch (250 mm) expansion coil in irrigation piping at each valve to which controls are connected, and at 100-fot (30 m) intervals. Bury control tubing beside pipe.

H. Mark valves with neoprene valve markers containing locking device. Set valve markers in pipe risers extending from top of valve to finish grade.

I. After piping is installed, but before outlets are installed and backfilling commences, open valves and flush system with full head of water.

3.05 FIELD QUALITY CONTROL

A. Prior to backfilling, test system for leakage at main piping to maintain 80 psi (690 kPa) pressure for one hour.

B. System is acceptable if no leakage or loss of pressure occurs and system self-drains during test period.

C. Location of the irrigation system heads, piping and valves shall be marked to avoid damage by others during completion of the landscape work. Sprinkler heads shall be set plumb and level to finish grade and shall be readjusted after landscape areas are completed to assure proper operation.

3.06 BACKFILLING

A. Backfill trench and compact to specified subgrade elevation. Protect piping from displacement.

3.07 SYSTEM STARTUP

A. Prepare and start system in accordance with manufacturer's instructions.

B. Adjust control system to achieve time cycles required.

C. Adjust head types for full water coverage as directed.

3.08 CLOSEOUT ACTIVITIES

A. Instruct Owner's personnel in operation and maintenance of system, including adjusting of sprinkler heads. Use operation and maintenance data as basis for demonstration.

B. As-Built Plan: Furnish an "as-built" drawing showing sprinkler heads, valves, drains, and pipelines to scale with dimensions where required.

3.09 MAINTENANCE

A. Provide a separate maintenance contract for specified maintenance service.

B. Provide one complete spring start-up and a fall shutdown by installer, at no extra cost to Owner. For a period of one year from date of final acceptance of work performed under this contract, the irrigation contractor shall promptly furnish, without cost to owner, all parts and labor which prove to be defective in material and workmanship.

END OF SECTION

SECTION 32 9219 – SEEDING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Grass seeding and fertilizing.

1.02 REFERENCES

A. FS O-F-241 - Fertilizers, Mixed, Commercial.

1.03 QUALITY ASSURANCE

A. Seed and seeding mixture shall be free of all prohibited noxious weed seed and will not contain more than one-half of 1 percent by weight of restricted noxious weed seeds.

B. Origin of the native seed harvest shall be limited to: North Dakota, South Dakota, northern Nebraska, eastern Wyoming, eastern Montana, western Minnesota and southern Manitoba, Canada.

C. All seed shall be tested by a commercial seed testing laboratory within 9 months prior to the planting.

D. The seed bags shall be delivered to the project bearing a tag which shows the following information:
   1. Name and address of supplier.
   2. Supplier's lot number for each kind of seed in the mixture.
   3. Origin (where grown) for each kind of seed.
   4. Purity and germination for each kind of seed.
   5. Date last tested.
   6. Pounds of bulk seed of each kind of seed in each bag.
   7. Total pounds of bulk seed mixture in each bag.
   8. Total pounds of pure live seed of each kind of seed in each bag.
   9. Total pounds of pure live seed mixture in each bag.
   10. Provide certificate of compliance from authority having jurisdiction indicating approval of seed mixture.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver seed mixture in sealed containers. Seed in damaged packaging is not acceptable.

B. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of Manufacturer.

PART 2 PRODUCTS

2.01 ACCESSORIES

A. Fertilizer: FS O-F-241; recommended for grass, with 50 percent of the elements derived from organic sources to the following proportions: Nitrogen 20 percent, phosphoric acid 20 percent, soluble potash 10 percent.

B. Water: Clean, fresh, and free of substances or matter that could inhibit vigorous growth of grass.

2.02 SEED MIXTURE

A. Irrigated Seed Mix:

	Grass Species	Percent
1.	Arc Kentucky Bluegrass	25%
2.	Fielder Kentucky Bluegrass	25%
3.	Park Kentucky Bluegrass	10%
4.	Shoreline Slender Fescue	15%
5.	Maxima 1 Creeping Red Fescue	15%
6.	Fine-Leaf Perennial Ryegrass	10%

B. Non-Irrigated Seed Mix – Early Season:

	Grass Species	Variety	Percent
1.	Western Wheatgrass	Rodan, Rosana, Walsh, Flintlock, W.R. Poole Recovery	28%
2.	Switchgrass	Dacotah, Forestburg, or Sunburst, Summer	9%
3.	Green Needlegrass	Lodorm, AC Mallard, Fowler	7%
4.	Sideoats Grama	Killdeer, Pierre, Butte	11%
5.	Slender Wheatgrass	Revenue, Primar, Adanac, Pryor, Firstrike	15%
6.	Oats	--	30%

C. Non-Irrigated Seed Mix – Late Season:

	Grass Species	Variety	Percent
1.	Western Wheatgrass	Rodan, Rosana, Walsh, Flintlock, W.R. Poole Recovery	27%
2.	Switchgrass	Dacotah, Forestburg, or Sunburst, Summer	5%
3.	Green Needlegrass	Lodorm, AC Mallard, Fowler	10%
4.	Canada Wilde-Rye	Mandan	15%
5.	Slender Wheatgrass	Revenue, Primar, Adanac, Pryor, Firstrike	14%
6.	Oats	--	29%

D. Temporary Cover Crop: Oats spread at a rate of 64 pounds pure live seed per acre

PART 3 EXECUTION

3.01 EXAMINATION

A. Prepare subgrade in accordance with Section 31 2200.

B. Place topsoil in accordance with Section 31 2200.

C. Verify topsoil is spread to a smooth uniform depth over area to be seeded.

D. Verify that prepared topsoil is ready to receive the Work of this Section.

3.02 FERTILIZING

A. Apply fertilizer at a rate of 15 pounds/10,000 square feet to all areas requiring seeding.

B. Apply after smooth raking of topsoil.

C. Do not apply fertilizer at same time or with same machine as will be used to apply seed.

D. Mix thoroughly into upper 2-inches of topsoil.

E. Lightly water to aid dissipation of fertilizer.

3.03 NORMAL GRASS SEEDING

A. Seed shall be uniformly distributed with a turfgrass drill seeder in two approximately perpendicular passes, at a rate of 3 pounds/1,000 SF per pass.

B. Broadcast spreaders or other approved methods may be employed in areas inaccessible to drill seeders.

C. Immediately following seed placement, all seeded areas shall be culti-packed or rolled with a roller not exceeding 112 pounds. Avoid over-compacting soil.

D. Do not sow immediately following rain, when ground is too dry, or during windy periods.

E. Following germination, immediately re-seed areas without germinated seeds that are larger than 4 by 4 inches.

3.04 PLANTING SEASON

A. If seeding is required for non-irrigated areas before April 20 or between July 16 and August 9, plant a temporary cover crop. Re-seed the area with the specified seed mixture between April 20 and July 15 or after August 10 and before the ground freezes.

B. If planting non-irrigated seed between April 20 and July 15, use the Early Season seed mixture specified.

C. If planting non-irrigated seed after August 10 and before the ground freezes, use the Late Season mixture specified.

3.05 QUALITY CONTROL

A. All equipment is subject to Architect’s approval before it is used.

B. Maintain seeded areas immediately after placement until final project acceptance.

C. Provide one-year written warranty with no exceptions from date of project acceptance for replacement of barren, dead, or unhealthy seeded areas. Warranty shall cover all costs for materials and installation.

END OF SECTION

SECTION 32 9488 – TREES, PLANTS, AND GROUND COVER

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Preparation of topsoil, types and rates of fertilizer application and requirements for new trees and shrubs.

B. Reference Standards:
   1. ANSI Z60.1 - Nursery Stock.

1.02 DEFINITIONS

A. Weeds: Any plant life not specified or scheduled.

B. Plants: Living trees, plants, and ground cover specified in this Section, and described in ANSI Z60.1.

1.03 SUBMITTALS

A. Maintenance Data: Include cutting and trimming method; types, application frequency, and recommended coverage of fertilizer.

B. Submit list of plant life sources.

1.05 QUALITY ASSURANCE

A. Nursery Qualifications: Company specializing in growing and cultivating the plants.

B. Installer Qualifications: Company specializing in installing and planting the plants.

C. Maintenance Services: Performed by Contractor through project acceptance.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect and maintain plant life until contract completion.

B. Deliver plant life materials immediately prior to placement. Keep plants moist.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Do not install plant life when ambient temperatures may drop below 35° F or rise above 90° F.

B. Do not install plant life when wind velocity exceeds 30 mph.

1.08 COORDINATION

A. Install plant life after and coordinate with installation of underground irrigation system piping and watering heads, where applicable.

PART 2 PRODUCTS

2.01 TREES, PLANTS, AND GROUND COVER

A. Trees and Plants: Species and size identifiable in plant schedule, grown in climatic conditions similar to those in locality of the Work.

2.02 SOIL AMENDMENT MATERIALS

A. Water: Clean, fresh, and free of substances or matter that could inhibit vigorous growth of plants.

B. Fertilizer: Contain 50 percent of the elements derived from organic sources; to the following proportions:
   1. Nitrogen – 18 percent
   2. Phosphoric acid – 46 percent
   3. Soluble potash – 0 percent

C. Peat Moss: shredded loose, sphagnum moss; free from lumps, roots, inorganic material or acidic materials; minimum of 85 percent organic material measured by oven dry weight, pH range 4 to 5; moisture content of 30 percent.

2.03 MULCH MATERIALS

A. Bark Mulch: Shall consist of oak or other hardwood bark mulch, double shredded, and substantially free of noxious weed seeds and objectionable foreign material.

2.04 ACCESSORIES

A. Wrapping Materials: Burlap

B. Stakes: Softwood lumber, pointed end.

C. Cable, Wire, Eye Bolts: Noncorrosive, of sufficient strength to withstand wind pressure and resulting movement of plant life.

D. Plant Protectors: Rubber sleeves over cable to protect plant stems, trunks, and branches.

E. Tree Protectors: Plastic

F. Landscape Border: Commercial grade edging being 3/16” thick (minimum) by 4” deep, aluminum of a color to be chosen by the architect.

G. Landscape Fabric:
   1. Type I - Equal to US 90NW as manufactured by US Fabrics.
   2. Type II - Black polypropylene weighing 3.25 ounces. per square yard (SY), a tensile strength of 193x114 pounds, a burst psi of 350, a puncture capacity of 83 pounds, permeability of 12.4 gallons per square foot (SF) per minute, 18 mil minimum thickness and a 5-year written guarantee against UV deterioration.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that prepared subsoil is ready to receive work.

B. Saturate soil with water to test drainage.

3.02 PLACING TOPSOIL

A. Place topsoil to a depth of 6-inches, minimum in areas to be grassed.

B. Place topsoil to a depth of 12-inches, minimum in areas where trees, shrubs and plants are to be placed.

3.03 PLANTING

A. Dig planting pits 6-inches larger than the root system.

B. Grade topsoil to eliminate rough, low or soft areas, and to ensure positive drainage.

C. Place plants for best appearance for review and final orientation by Architect.

D. Set plants vertical.

E. Remove non-biodegradable root containers.

F. Set plants in pits same depth as plants being planted. Remove burlap, ropes, and wires, from root ball.

G. Saturate soil with water when the pit or bed is half full of topsoil and again when full.

3.04 INSTALLATION OF MULCH

A. Place Bark Mulch around all existing and proposed trees: 6-foot diameter, 3-inches thick, unless otherwise noted.

3.05 INSTALLATION OF ACCESSORIES

A. Install landscape border vertically and flush with the adjacent grass turf using metal stakes at 7-foot on-center maximum.

B. Place landscape fabric above the topsoil with cutouts around plantings.

C. Wrap deciduous shade and flowering tree trunks and place tree protectors.

3.06 PLANT SUPPORT

A. Brace plants vertically with plant protector wrapped guy wires and stakes to the following:

TREE CALIPER	TREE SUPPORT METHOD
1 inch	1 stake with one tie
1 - 2 inches	2 stakes with two ties
2 - 4 inches	3 guy wires
Over 4 inches	4 guy wires

3.07 FIELD QUALITY CONTROL

A. Plants will be rejected if the ball of earth surrounding roots has been disturbed or damaged prior to or during planting.

3.08 WARRANTY

A. Provide one-year written warranty with no exceptions for one continuous growing season from date of project acceptance for replacement of dead or unhealthy plants. Warranty shall cover all costs for materials and installation.

B. Replacement plants of same size and species as specified, planted in the next growing season, with a new warranty commencing on date of replacement.

END OF SECTION

SECTION 33 11 16 – SITE WATER UTILITY DISTRIBUTION PIPING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Pipe and fittings for domestic water lines.

B. Reference Standards (The current standard as of the date noted on the plans shall be utilized, unless noted otherwise):
   1. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.
   2. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts.
   3. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
   4. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
   5. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
   6. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
   7. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
   8. ASTM D3035 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
   9. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals.
   10. AWWA C104/A21.4 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings; American Water Works Association (ANSI/AWWA C104/A21.4).
   11. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; American Water Works Association (ANSI/AWWA C105/A21.5).
   12. AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings.
   13. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; American Water Works Association (ANSI/AWWA C111/A21.11).
   14. AWWA C115/A21.15 - Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
   15. AWWA C153/A21.53 - Ductile-Iron Compact Fittings.
   16. AWWA C515 - Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Servic.
   17. AWWA C550 - Protective Interior Coatings for Valves and Hydrants.
   18. AWWA C605 - Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings.
   19. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution.
   20. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. (13 mm) Through 3 In. (76 mm), for Water Service.
   21. Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers - Recommended Standards For Water Works.
   22. NSF/ANSI 61 - Drinking Water System Components - Health Effects.

1.02 SUBMITTALS

A. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories.

B. Project Record Documents: Record actual locations of piping mains, valves, connections, thrust restraints, and invert elevations. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.03 QUALITY ASSURANCE

A. Perform Work in accordance with City requirements.

PART 2 PRODUCTS

2.01 GENERAL

A. All products or materials that may come into contact with water intended for use in a public water system shall meet the National Sanitary Foundation International (NSF)/American National Standards Institute (ANSI) Standard 61.

B. The Contractor shall notify and obtain permission from the Fire Department having jurisdiction at least 24 hours prior to the shutting down service to any hydrant and shall notify the Fire Department when service is restored. The Contractor shall notify and coordinate shutting down any water lines with the municipality having jurisdiction.

2.02 WATER PIPE - 3 INCH AND LARGER

A. Polyvinyl Chloride Pipe: Polyvinyl Chloride Pipe shall meet the requirements of AWWA C900 or C905, or the latest revision thereof, and shall be furnished in cast iron pipe equivalent outside diameters with elastomeric joints. Pressure rating shall be 235 psi (DR18). All water main fittings shall be ductile iron.
   1. Ductile Iron Fittings: Ductile Iron fittings shall be manufactured by Harco, Trinity Valley, or approved equal, and shall have a working pressure of 350 pounds per square inch conforming with AWWA/ANSI C153/A21.53 or AWWA/ANSI C110/A21.10. All Ductile Iron fittings shall be cement mortar lined and contain an exterior bituminous seal conforming with AWWA/ANSI C104/A21.4. All fittings shall be mechanically restrained and have thrust blocking. Thrust blocking shall be of adequate size to prevent movement of pipe and appurtenances when under pressure. Minimum bearing area shall be 2 square feet.
   2. Mechanical joints shall be manufactured in accordance with AWWA/ANSI C111/A21.11.
   3. Mechanical Joint Bolt Requirements: Bolts for mechanical joint fittings, valves, and hydrants shall be alternated with one-half stainless steel and one-half low alloy steel. Low alloy steel bolts shall contain a maximum content of carbon at 0.2 percent, manganese at 1.25 percent, sulphur at 0.5 percent, minimum content of nickel at 0.25 percent, and a combined content of nickel, copper, and chromium at 1.25 percent. Stainless steel bolts shall be Grade 304.
   4. Pipe Coupling: ASTM A283 Grade C Steel with fusion-bonded epoxy coating and stainless steel nuts and bolts.
      a. 12” & Smaller: Romac MACRO HP or approved equal.
      b. Larger than 12”: Ford, Dresser, Mueller, Hymax, or approved equal.
   5. Restrained Joints: Where shown on the plans, restrained joint pipe and fittings shall be used. Preapproved restraining systems include Certa-Lok, Yelomine, and EBAA Iron, Inc (MEGALUG). Approved equals may also be used.

2.03 WATER PIPE - LESS THAN 3 INCH

A. Service Connection:
   1. Bronze, 2-piece service saddle
   2. Ford - Service Saddle, Style S71
   3. Or equal

B. Corporation Stop:
   1. Ford – FB1101-NL
   2. Or equal

C. Ball Valves:
   1. Ford 1" Ball Valve – B66-444-NL
   2. Or equal

D. Pipe and Fittings:
   1. Polyethylene Pipe: HDPE 4710 conforming to ASTM D2239, SIDR-7 (IPS) with a minimum pressure rating of 250 psi.
   2. All fittings shall be red brass (no lead brass).
   3. All corporations and curb stops shall be ball style valves.

2.04 BEDDING AND COVER MATERIALS

A. Bedding: As specified in Section 31 2333 – Trenching and Backfilling.

B. Cover: As specified in Section 31 2333 – Trenching and Backfilling.

2.05 ACCESSORIES

A. Insulation Boards: The insulation shall have a thermal conductivity of not more than 0.28 BTU per hour per square foot per degree Fahrenheit per inch of thickness as tested in accordance with ASTM C177. The insulation shall not absorb moisture to an extent greater than 2.5 percent by volume as tested in accordance with ASTM D2127. The compression strength of the insulation shall be greater than 20 psi as tested in accordance with ASTM D-1621. The density of the insulation shall be between 0.9 and 1.3 pounds per cubic feet as tested in accordance with ASTM D-1622. The insulation shall be specifically designed for protection of underground utilities.

B. Polyethylene Encasements: All ductile iron and cast-iron pipe, valves, valves boxes, fittings, couplings and hydrants shall be encased with 8-mil linear low- density (LLD) polyethylene film in accordance with ANSI/AWWA C105/A21.5.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that connection sizes, locations, and inverts are as indicated.

B. Notify utility companies before digging. Verify all related work is at appropriate stage of completion.

C. Before any City watermain is cut, measure the outside diameter (O.D.) of the pipe with an O.D. tape to make sure contractor has the correct fittings to complete the job. The contractor shall be responsible for any damages or delays caused by not having the correct fittings available.

D. AC Pipe: If Asbestos Cement pipe is encountered, Contractor shall follow and comply with the North Dakota Department of Environmental Quality (NDDEQ) requirements for the handling of asbestos material. All costs associated with NDDEQ and City coordination, forms and applications, handing, transporting and disposal of AC pipe will be considered incidental and included in the associated water system connection. All related communication including applications, forms, and certifications will be copied to the Architect.

3.02 PREPARATION

A. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare pipe connections to equipment with flanges or unions.

3.03 TRENCHING

A. Prepare trench in accordance with Section 31 2333 Trenching and Backfilling.

B. Hand trim excavation for accurate placement of pipe to elevations indicated.

C. Form and place concrete pipe thrust restraints per details.

D. See Section 31 2333 Trenching and Backfilling for backfilling and pipe bedding requirements.

3.04 UTILITY CROSSINGS

A. Separation between water and sanitary sewer piping shall be provided as follows:
   1. Provide a minimum horizontal separation of 10 feet measured from edge of water pipe to edge of sanitary sewer pipe.
   2. Provide a minimum vertical separation of 18 inches measured from edge of water pipe to edge of sanitary sewer pipe.
   3. At all crossings, both water pipe and sanitary sewer pipe shall be installed with a full pipe section centered over a full pipe section. Sewer joints shall be installed equidistant and as far as possible from water pipe joints. Where water pipe crosses under a sewer, adequate structural support shall be provided for the sewer to maintain line and grade.
   4. Minimum separation between water and sanitary sewer lines shall be 18 inches at all crossings, whether water is over or under sewer.
   5. If it is impossible to obtain proper horizontal and vertical separation as stipulated above, reviewing agency approval must be obtained on a case-by-case basis to utilize one of the following methods:
      a. Sanitary sewer shall be designed and constructed to water pipe standards and shall be pressure tested at 150 psi for a period of one hour to assure water tightness.
      b. Either the water main or the sewer line may be encased in a watertight carrier pipe which extends 10 feet on both sides of the crossing, measured perpendicular to the water main. The carrier pipe shall be of materials specified for use in water main construction.

3.05 INSTALLATION - PIPE

A. Establish elevations of buried piping to ensure not less than 7'-6" ft (2.3 m) of cover to crown. See plans for invert elevations, if applicable.

B. Install pipe to indicated elevation to within tolerance of 1/2 inch (13 mm).

C. Route pipe in straight line. Joint deflections shall not exceed manufacturers recommendations.

D. Install insulation if indicated on the plans.

E. Slope water pipe and position drains at low points.

3.06 FIELD QUALITY CONTROL

A. Perform trench backfill testing in accordance with Section 31 2333 Trenching and Backfilling.

3.07 CLEANUP AND PROJECT CLOSEOUT

A. Prior to project acceptance, open and close each hydrant valve and observe the barrel drain down in presence of The City.

B. Verify proper hydrant threads by obtaining hose section from The City and demonstrating the fit to The City's representative.

C. Where hydrant drains have been plugged due to high groundwater, Contractor shall paint pumper nozzle yellow.

D. Verify all valve and curb boxes have been raised to grade.

3.08 PROJECT RECORD DOCUMENTS

A. Accurately record location of pipe runs, connections, and termination points on “as constructed” plans.

B. Identify, describe and show approximate location of newly discovered utilities during excavation.

C. Furnish all operational data, including Manufacturer's instructions, parts lists, and maintenance data to Architect.

END OF SECTION

SECTION 33 3100 – SANITARY UTILITY SEWERAGE PIPING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Exterior sanitary sewerage drainage piping, fittings, and accessories.

B. Reference Standards:
   1. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
   2. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
   3. ASTM D2466 Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
   4. ASTM 2729 – Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
   5. ASTM D3034 – Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
   6. ASTM F477 – O-ring rubber gaskets for PVC sewer pipe joints.
   7. North Dakota State Plumbing Code.
   8. North Dakota State Department of Health Rules and Regulations (10 State Standards).

1.02 SUBMITTALS

A. Product Data: Provide data indicating pipe, pipe accessories.

B. Project Record Documents:
   1. Record location of pipe runs, connections, catch basins, cleanouts, and invert elevations.
   2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

PART 2 PRODUCTS

2.01 SEWER PIPE MATERIALS

A. Provide products that comply with applicable code(s) and local ordinances.

B. Gravity Pipe (less than 20-feet deep):
   1. ASTM D1785, Schedule 40, PolyVinyl Chloride (PVC) material, bell and spigot style solvent sealed joint end.
   2. SDR-35, gasketed bell and spigot

C. Gravity Pipe (Greater than or equal to 20-feet deep): SDR-26, gasketed bell and spigot

D. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required. Shall meet requirements of ASTM D3034.

E. Forcemains: Schedule 40 PVC

2.02 BEDDING AND COVER MATERIALS

A. Pipe Bedding Material: As specified in Section 31 2333 – Trenching and Backfilling.

B. Pipe Cover Material: As specified in Section 31 2333 – Trenching and Backfilling.

PART 3 EXECUTION

3.01 GENERAL

A. Perform work in accordance with applicable code(s).

3.02 TRENCHING AND BACKFILLING

A. See Section 31 2333 – Trenching and Backfilling for requirements.

3.03 INSTALLATION - PIPE

A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings.

B. Install pipe, fittings, and accessories in accordance with manufacturer's instructions. Seal watertight.

C. Lay pipe to slope gradients noted on layout drawings; with maximum variation from true slope of 1/8-inch in 10-feet.

D. Flush pipe when laying operations are completed.

E. Maintain separation of water lines from sewer piping as follows:
   1. Parallel Installation:
      a. Watermains shall be laid at least 10-feet horizontally from any existing or proposed gravity sanitary or storm sewer, septic tank, or subsoil treatment system. The distance shall be measured edge to edge.
      b. In cases where it is not practical to maintain a 10-foot separation, the reviewing authority may allow deviation on a case-by-case basis, if supported by data from the design engineer.
   2. Crossings:
      a. Watermains crossing sewers shall be laid to provide a minimum vertical distance of 18-inches between the outside of the watermain and then outside of the sewer. This shall be the case where the watermain is either above or below the sewer with preference to the watermain located above the sewer.
      b. At crossings, one full length of water pipe shall be located so both joints will be as far from the sewer as possible. Special structural support for the water and sewer pipes may be required.
   3. Exception: When it is impossible to obtain the minimum specified distance, the reviewing authority must specifically approve any variance. Where sewers are being installed the following methods of installation may be used:
      a. Such deviation may allow installation of the watermain closer to a sewer, provided that the watermain is laid in a separate trench or on an undisturbed earth shelf located on one side of the sewer at such an elevation that the bottom of the watermain is at least 18-inches above the top of the gravity sewer.

b. The sewer materials shall be water works grade 150 psi (1.0 Mpa) pressure rated pipe meeting AWWA standards or pipe approved by the reviewing authority and shall be pressure tested to ensure water tightness.

4. Force mains: There shall be at least a 10-foot horizontal separation between watermains and sanitary sewer force mains. There shall be an 18-inch vertical separation at crossings as required in item 2 – Crossings.
5. Sewer Manholes: No water pipe shall pass through or come in contact with any part of a sewer manhole. Watermain should be located at least 10-feet from sewer manholes.

3.04 INSTALLATION - CLEANOUTS

A. Form bottom of excavation clean and smooth to correct elevation.

B. Form and place cast-in-place concrete base pad, with provision for sanitary sewer pipe end sections.

C. Establish elevations and pipe inverts for inlets and outlets as indicated.

D. Mount lid and frame level in grout, secured to top cone section to elevation indicated.

3.05 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of piping, valves, connections, and invert elevations where applicable on “as constructed” plans.

B. Identify and describe the discovery of uncharted utilities.

C. Provide Architect with a complete set of "as constructed" plans showing ties to all connections and termination points of all piping and appurtenances prior to final payment.

END OF SECTION

SECTION 33 4721 – STORM SEWERAGE SYSTEM

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Storm sewer drainage piping, fittings, inlets, basins, and accessories.

B. Reference Standards:
   1. ASTM A48 – Cast Iron Grates and Frames.
   2. ASTM C14 – Non-reinforced Concrete Pipe.
   3. ASTM C76 – Reinforced Concrete Culvert, Storm Drain and Sewer Pipe.
   4. ASTM C175 – Mortar Cement.
   5. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
   6. ASTM C478 – Precast Reinforced Concrete Manhole Sections.
   7. ASTM C497 – Methods of Testing Concrete Pipe, Manhole Sections or Tile.
   8. ASTM C506 – Reinforced Concrete Arch Culvert, Storm Drain and Sewer Pipe.
   9. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
   10. ASTM D2321 Standard Practice for Underground Installation of Thermoplastic Pipe.
   11. ASTM D2729 – Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
   12. ASTM D3034 – Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
   13. ASTM D3212 - Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
   14. ASTM D3350 – Standard Specification for Polyethylene Plastics Pipe & Fitting Materials.
   15. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
   16. ASTM F679 – Poly (Vinyl Chloride) AC Large Diameter Plastic Gravity Sewer Pipe and Fittings.
   17. ASTM F2306 / F2306M - Standard Specification for 12 to 60 in. Annular Corrugated Profile Wall Polyethylene (PE) Pipe and Fittings for Gravity Flow Storm Sewer and Subsurface Drainage Applications.
   18. ASTM F2648 - Standard Specification for 2 to 60 inch [50 to 1500 mm] Annular Corrugated Profile Wall Polyethylene (PE) Pipe and Fittings for Land Drainage Applications.
   19. ASTM F2736 - Standard Specification for 6 to 30 in. (152 To 762 mm) Polypropylene (PP) Corrugated Single Wall Pipe And Double Wall Pipe.
   20. ASTM F2881 - Standard Specification for 12 to 60 in. [300 to 1500 mm] Polypropylene (PP) Dual Wall Pipe and Fittings for Non-Pressure Storm Sewer Applications.
   21. AASHTO M-196 – Corrugated Aluminum Alloy Pipe.
   22. AASHTO M-246 – Polymeric-Coated (Pre-Coated) Corrugated Metal Pipe.
   23. AASHTO M-252 and M-294 Standard Specifications for Corrugated Polyethylene Pipe 12 inch to 36 inch.
   24. North Dakota State Department of Health Rules and Regulations (10 State Standards).

1.02 SUBMITTALS

A. Provide Manufacturer's data indicating pipe specifications, pipe accessories, fittings and appurtenances.

B. Indicate special procedures required to install products specified.

C. Certify that products supplied meet or exceed specified requirements.

1.03 QUALITY ASSURANCE

A. Stamp each section of pipe and all fittings with the following minimum information:
   1. Concrete Pipe:
      a. Class of Pipe.
      b. Date of Manufacture.
      c. Name or Trademark of Manufacturer.
   2. PVC Pipe:
      a. Name of Manufacturer.
      b. Nominal Pipe Size.
      c. PVC Cell Classification.
      d. PSM, PS and SDR Value.
      e. Applicable ASTM and Code number.
   3. Corrugated Polyethylene Pipe:
      a. Name of Manufacturer.
      b. Size.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. North Dakota Concrete Products for concrete pipe, manholes and inlets.

B. Certainteed, Northern Pipe Products for PVC.

C. Advanced Drainage Systems, Inc. (ADS) and HANCOR for polyethylene and polypropylene pipe products.

D. Neenah Foundry Company, East Jordan Iron Works, or approved equal, for grates and castings.

E. Approved Equals

2.02 MATERIALS

A. Reinforced Concrete Storm Sewer Pipe: Conform to the requirements of ASTM C76. Unless otherwise Specified, all pipe shall be Class III for 24-inch and smaller and Class II for 27-inch and larger in accordance with ASTM C76, Wall B. All pipe sections shall be cast in sections 8-feet, 6-feet, or 4-feet long, except that the variable length sections may be cast in order to match at manholes and inlets.

B. Polyvinyl Chloride Storm Sewer Pipe: Polyvinyl chloride storm sewer (PVC) pipe 15-inches or smaller shall conform to the requirements of ASTM D3034 for type PSM, PVC sewer pipe and shall have an SDR of 35, all of which shall be stamped on the pipe. Polyvinyl chloride sewer pipe 18-inches or larger shall conform to the requirements of ASTM F679-PS46. PVC sewer shall have the elastomeric gasket type joint providing a watertight seal.
   1. Schedule 40 PVC pipe conforming to ASTM D1785 and ASTM D2665 shall be considered an "or equal" substitution for SDR 35 PVC pipe.

C. Corrugated Polyethylene Pipe: Corrugated Polyethylene Pipe shall be N-12 WT IB per ASTMF2648 as manufactured by ADS, Inc. or approved equal, with integral bell and spigot joints.
   1. 4- through-60-inch joints shall be watertight according to the requirements of ASTM D3212. Gaskets shall meet the requirements of ASTM F477. Gaskets shall be installed by the pipe manufacturer and covered with a removable, protective wrap to ensure the gasket is free from debris. A joint lubricant available from the manufacturer shall be used on the gasket and bell during assembly.

2. 12- through-60-inch diameters shall have a reinforced bell with a polymer composite band. The bell tolerance device shall be installed by the manufacturer.
3. Fittings shall conform to ASTM F2306. Bell and spigot connections shall utilize a spun-on or welded bell and valley or saddle gasket meeting the watertight joint performance requirements of ASTM F2306.

D. Polypropylene Pipe: Corrugated Polypropylene Pipe shall be ADS HP Storm as manufactured by ADS, Inc. or approved equal, with smooth interior walls and gasketed, integral bell and spigot joints.
1. 12-through-30-inch (300 to 750 mm) pipe shall have a smooth interior and annular exterior corrugations and meet or exceed ASTM F2736 and AASHTO M330.
2. 36-through-60-inch (900 to 1500 mm) pipe shall have a smooth interior and annular exterior corrugations and meet or exceed ASTM F2881 and AASHTO M330.
3. Pipe shall be joined with a gasketed integral bell & spigot joint meeting the requirements of ASTM F2736 or F2881, for the respective diameters.
4. 12-through-60-inch (300 to 1500 mm) pipe joints shall be watertight according to the requirements of ASTM D3212. Spigots shall have gaskets meeting the requirements of ASTM F477. Gasket shall be installed by the pipe manufacturer and covered with a removable, protective wrap to ensure the gasket is free from debris. A joint lubricant available from the manufacturer shall be used on the gasket and bell during assembly. Pipe bells shall be reinforced with a polymer composite band, installed by the manufacturer.
5. Fittings shall conform to ASTM F2736, ASTM F2881 and AASHTO M330, for the respective diameters. Bell & spigot connections shall utilize a spun-on, welded or integral bell and spigot with gaskets meeting ASTM F477. Bell & spigot fittings joint shall meet the watertight joint performance requirements of ASTM D3212. Corrugated couplings shall be split collar, engaging at least 2 full corrugations.
6. Polypropylene compound for pipe and fitting production shall be impact modified copolymer meeting the material requirements of ASTM F2736, Section 4, ASTM F2881, Section 5 and AASHTO M330, Section 6.1, for the respective diameters.

E. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tees, bends, elbows, cleanouts, reducers, traps and other configurations.

F. Pipe Bedding and Backfill: As specified in Section 31 2333.

G. Pipe bedding and installation shall conform to all manufacturer’s requirements.

H. Pipe Joints:
1. Concrete – Tongue and Grove.
2. PVC – Integral Bell and Spigot.
3. High Density Polyethylene – Integral Bell and Interlock.
4. Steel and Aluminum - Coupling bands which overlap a minimum of 2 corrugations on each end of the pipe. All anchor bolts must be type 304 stainless steel.

I Mortar Mix: Composed on 1 part by volume Type 1A Portland Cement and 2 parts of mortar sand.

J. Inlet Structures: Round, square or rectangular as shown on the plans. May be precast or cast in-place. Includes concrete base, invert, casting and two adjusting rings.

K. Inlet Castings and Grates: Single, double, or triple casting which solidly fits on inlet structures and does not rock or rattle when traffic crosses. Manufactured from Class 35B Gray (Cast) Iron.
1. Provide curb and/or gutter inlet frames and grates of a quality equal to the Neenah Foundry, East Jordan Iron Works or approved equal. Provide castings as indicated by the Plans.

L. Manhole Frames and Lids: Equal to Neenah R-1733 or Municipal Casting 306. Lids equal to Neenah Type "K" manufactured from Class 35B Gray (Cast) Iron. Lid and casting must fit on manhole in a solid manner without rocking or rattling when traffic crosses.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that all area utilities have been located and marked.

B. Verify that excavations are ready to receive Work, and dimensions, and elevations are as indicated on drawings.

C. Verify that pipe and manholes needed are on site and free of defects.

3.02 INSTALLATION

A. Strip all topsoil to a depth of at least 4-inches and stockpile away from excavation and backfill material.

B. Perform excavation to the required elevations.

C. Maintain a trench width 24-inches (12 inches on each side of pipe centered in trench) greater than outside diameter of pipe.

D. Install pipe, manholes, fittings, and accessories in accordance with the line and grade established in the field and manufacturer's instructions. Seal joints watertight.

E. Maintain separation of water lines from sewer piping as follows:
   1. Parallel Installation:
      a. Watermains shall be laid at least 10-feet horizontally from any existing or proposed gravity sanitary or storm sewer, septic tank, or subsoil treatment system. The distance shall be measured edge to edge.
      b. In cases where it is not practical to maintain a 10-foot separation, the reviewing authority may allow deviation on a case-by-case basis, if supported by data from the Design Engineer.
   2. Crossings:
      a. Watermains crossing sewers shall be laid to provide a minimum vertical distance of 18-inches between the outside of the watermain and the outside of the sewer. This shall be the case where the watermain is either above or below the sewer with preference to the watermain located above the sewer.
      b. At crossings, one full length of water pipe shall be located so both joints will be as far from the sewer as possible. Special structural support for the water and sewer pipes may be required.
   3. Exception: When it is impossible to obtain the minimum specified distance, the reviewing authority must specifically approve any variance. Where sewers are being installed the following methods of installation may be used:
      a. Such deviation may allow installation of the watermain closer to a sewer, provided that the watermain is laid in a separate trench or on an undisturbed earth shelf located on one side of the sewer at such an elevation that the bottom of the watermain is at least 18-inches above the top of the gravity sewer.
      b. The sewer materials shall be water works grade 150 psi (1.0 Mpa) pressure rated pipe meeting AWWA standards or pipe approved by the reviewing authority and shall be pressure tested to ensure water tightness.

4. Force mains: There shall be at least a 10-foot horizontal separation between watermains and sewer force mains. There shall be an 18-inch vertical separation at crossings as required in item 2 - Crossings.
5. Sewer Manholes: No water pipe shall pass through or encounter any part of a sewer manhole. Watermain should be located at least 10-feet from sewer manholes.

F. Install appropriate bedding (per manufacturer's specifications) for type of pipe being installed.

G. Install haunching for the width of the trench up to the center (springline) of the pipe in no more than 6-inch lifts and thoroughly compact each lift before placing the next lift.

H. Check and maintain compacted density in pipe haunching.

I. Keep all pipe, manholes and inlets clean and free of dirt and debris.

J. If unexpected or unmarked utility lines are encountered immediately notify Architect.

K. Backfill and compact remainder of pipe trench. Do not allow equipment to cross pipe until pipe has a minimum of 12-inches of compacted cover.

L. Remove large stones or other hard matter which could damage piping or impede consistent backfilling or compaction.

M. Install inlet grates, flap gates, headwalls, riprap and other appurtenant items as required by plans.

N. Evenly distribute topsoil or roadway surfacing as required when all backfilling and compacting has been completed.

3.03 TOLERANCES

A. Install all gravity pipe to the following tolerances:
1. Vertical tolerances – ±0.06 feet of staked grade line.
2. Horizontal tolerance – ± 0.06 feet of staked alignment.
3. Separation tolerance – minimum of 10-feet outside diameter between mains

3.04 FIELD QUALITY CONTROL

A. Place pipe by utilizing either a laser or a batter board system.

B. Notify Architect prior to placing cover over pipe.

C. Employ an experienced, knowledgeable person to oversee the setting of grades, pipe handling, placement and backfilling.

3.05 MANUFACTURER'S FIELD SERVICES

A. If pipe installation involves special trench protection, has special loading concerns, or requires special bedding and haunching, contact supplier who shall request assistance from Manufacturer as needed.

3.06 CLEANUP AND PROJECT CLOSEOUT

A. When all installation is complete, clean the site of all debris, left over pipes, fittings, and equipment.

B. Remove all debris from pipe and flush pipe. Dispose of debris.

3.07 PROJECT RECORD DOCUMENTS

A. Accurately record all installed items on “as-constructed” plans.

B. Identify, describe and show any previously uncharted underground

END OF SECTION

SECTION 33 3000 – SANITARY SEWERAGE UTILITIES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Exterior sanitary sewerage drainage piping, fittings, and accessories.
   2. Sanitary sewerage lift station components.

B. Reference Standards: (The current standard as of the date noted on the plans shall be utilized, unless noted otherwise)
   1. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
   2. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
   3. ASTM D2466 Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
   4. ASTM 2729 – Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
   5. ASTM D3034 – Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
   6. ASTM F477 – O-ring rubber gaskets for PVC sewer pipe joints.
   7. North Dakota State Plumbing Code.
   8. North Dakota State Department of Health Rules and Regulations (10 State Standards).

1.02 SUBMITTALS

A. Product Data: Provide data indicating pipe, pipe accessories.

B. Project Record Documents:
   1. Record location of pipe runs, connections, catch basins, cleanouts, and invert elevations.
   2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

C. Submit complete shop drawings and material certification(s) for wet well(s), pumps, motors, valves, hatches, electrical materials, concrete, pipe materials, and coatings

PART 2 PRODUCTS

2.01 SEWER PIPE MATERIALS

A. Provide products that comply with applicable code(s) and local ordinances.

B. Gravity Pipe (less than 20-feet deep):
   1. ASTM D1785, Schedule 40, PolyVinyl Chloride (PVC) material, bell and spigot style solvent sealed joint end.
   2. SDR-35, gasketed bell and spigot

C. Gravity Pipe (Greater than or equal to 20-feet deep): SDR-26, gasketed bell and spigot

D. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required. Shall meet requirements of ASTM D3034.

E. Rubber Gaskets for Joining Pipe: Elastomeric type providing a watertight seal conforming to ASTM D3212.

F. Forcemains (Outside Lift Station Structure): Schedule 40 PVC

G. Marking Tape: Furnish and install marking tape located 2 feet above the top of all sewer mains. The tape shall be of the non-detectable type and shall have a minimum width of 5 inches. The tape shall be green in color with the words "CAUTION SEWER LINE BELOW" imprinted on the tape in black capital letters.

2.02 LIFT STATION MATERIALS

A. Precast Structure: As specified in Section 33 0513 – Manholes and Structures.

B. Access Hatch:
1. Door leaf shall be minimum ¼" aluminum pattern plate reinforced to withstand a live load of 300 pounds per square foot. Frame shall be ¼" aluminum with an anchor flange around the perimeter. Doors shall be equipped with heavy forged brass or stainless steel hinges, stainless steel pins, and an automatic hold-open arm with release handle. Provide a staple for padlock and an aluminum lifting handle. The lifting handle shall recess into the door when not in use. Hardware shall be cadmium plated and factory finish. The frame shall be mill finish with bituminous coating applied to exterior channels where they come in contact with the frame. Door assemblies shall meet OSHA requirements. On all door leafs with any dimension greater than 36 inches, supply compression springs to assist opening.
2. Provide safety grate option and keyed locks for all access hatches. Two of each key shall be provided and keys shall be tagged for lock location. Safety grating shall be manufactured with 1" square molded fiberglass or steel and be capable of supporting 300 lbs/SF.

C. Pumps
1. Provide a pump meeting the requirements listed on the Plans.
2. Pumps shall have a 2-year minimum manufacturer's warranty against defects.

D. Control Panel
1. Use a duplex control panel system that will alternate pump use.
2. Panel shall be NEMA 4X rated.
3. Panel shall meet the same electrical requirements as the pump and shall be approved for use with the selected pump.
4. Panel shall be equipped with high-water audio and visual alarms.
5. Panel shall be mounted near the lift station at eye level.

E. Guide Rail System
1. A guide rail system shall be furnished and installed for each pump designed to operate under the expected head and flow conditions. The system shall be designed such that the pumps can be easily removed from the wet well without entering the well or disconnecting piping.
2. The system shall consist of a 90° discharge elbow with support leg, stationary base support, slide rail pump assembly, steel guide rails, upper, lower and intermediate stainless steel guide rail supports, and stainless steel lifting yoke, cable and eyes. The foot-mounted discharge elbow and adapter shall conform to ASTM A48 Class 25 or 30 grey iron. Guide rails shall be constructed using Type 326 stainless steel.
3. The stationary base shall be constructed of ductile iron, integrally cast. The slide face shall be constructed of Class 35 cast iron. The coupling shall incorporate a self-energizing gasket to provide positive sealing under all conditions. All bolts, nuts, screws, and miscellaneous accessories not otherwise noted shall be 316 stainless steel.

4. The guide rail system shall be a standard product of the pump manufacturer, using materials specified above.

F. Pipe (Inside Lift Station Vault):
   1. ASTM D1785, Schedule 80, PolyVinyl Chloride (PVC) material, bell and spigot style solvent sealed joint end.

H. Electrical Splice Junction Box: Shall be located in an easily accessible location adjacent to the wet well to provide easy access for inspection and servicing. Shall be made of corrosion resistant materials. Junction boxes are not permitted to be located on top of or within the wet well. The electrical splice box shall be UL approved for wet locations.

2.03 BEDDING AND COVER MATERIALS

A. Pipe Bedding Material: As specified in Section 31 2333 – Trenching and Backfilling.

B. Pipe Cover Material: As specified in Section 31 2333 – Trenching and Backfilling.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that all area utilities have been located and marked.

B. Verify that excavations are ready to receive Work, and dimensions, and elevations are as indicated on drawings.

C. Verify that pipe and manholes needed are on site and free of defects.

3.02 TRENCHING AND BACKFILLING

A. See Section 31 2333 – Trenching and Backfilling for requirements.

3.03 INSTALLATION - PIPE

A. Install pipe, fittings, and accessories as shown by the Plans in accordance with manufacturer's instructions. Seal watertight.

B. Protect all pipe installed by maintaining a temporary plug in the end of each section until next section is installed.

C. Lay pipe to slope gradients noted on layout drawings; with maximum variation from true slope of 1/8-inch in 10-feet.

D. Clean and inspect each section of pipe and gasket before installation.

E. Backfill and hand compact up both sides of pipe to 12 inches (compacted depth) above top of pipe.

F. When pipe of different materials are to be jointed, an approved compression type coupling shall be used.

G. Flush pipe when laying operations are completed.

3.04 INSTALLATION – UTILITY CROSSINGS

A. Maintain separation of water lines from sewer piping as follows:
   1. Parallel Installation:
      a. Watermains shall be laid at least 10-feet horizontally from any existing or proposed gravity sanitary or storm sewer, septic tank, or subsoil treatment system. The distance shall be measured edge to edge.
      b. In cases where it is not practical to maintain a 10-foot separation, the reviewing authority may allow deviation on a case-by-case basis, if supported by data from the design engineer.
   2. Crossings:
      a. Watermains crossing sewers shall be laid to provide a minimum vertical distance of 18-inches between the outside of the watermain and then outside of the sewer. This shall be the case where the watermain is either above or below the sewer with preference to the watermain located above the sewer.
      b. At crossings, one full length of water pipe shall be located so both joints will be as far from the sewer as possible. Special structural support for the water and sewer pipes may be required.
   3. Exception: When it is impossible to obtain the minimum specified distance, the reviewing authority must specifically approve any variance. Where sewers are being installed the following methods of installation may be used:
      a. Such deviation may allow installation of the watermain closer to a sewer, provided that the watermain is laid in a separate trench or on an undisturbed earth shelf located on one side of the sewer at such an elevation that the bottom of the watermain is at least 18-inches above the top of the gravity sewer.
      b. The sewer materials shall be water works grade 150 psi (1.0 Mpa) pressure rated pipe meeting AWWA standards or pipe approved by the reviewing authority and shall be pressure tested to ensure water tightness.
   4. Force mains: There shall be at least a 10-foot horizontal separation between watermains and sanitary sewer force mains. There shall be an 18-inch vertical separation at crossings as required in item 2 – Crossings.
   5. Sewer Manholes: No water pipe shall pass through or come in contact with any part of a sewer manhole. Watermain should be located at least 10-feet from sewer manholes.

3.05 TOLERANCES

A. Install pipe to the following tolerances:
   1. Vertical tolerances – plus or minus 0.05 feet of staked grade line.
   2. Horizontal tolerance – plus or minus 0.05 feet of staked alignment.

3.06 FIELD QUALITY CONTROL

A. Owner will hire a third-party testing firm to perform trench backfill testing in accordance with Section 31 2333 Trenching and Backfilling.

B. Employ an experienced, knowledgeable person to oversee the setting of grades, pipe handling, placement and backfilling.

C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no additional cost.

3.07 CLEANUP AND PROJECT CLOSEOUT

A. When all installation is complete, clean the site of all debris, left over pipes, fittings, and equipment.

B. Remove all debris and sediment from pipe. Dispose of debris.

3.08 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of piping, valves, connections, and invert elevations where applicable on “as constructed” plans.

B. Identify and describe the discovery of uncharted utilities.

C. Provide Architect with a complete set of "as constructed" plans showing ties to all connections and termination points of all piping and appurtenances prior to final payment.

D. Instruct the Owner in the operation of the lift station controls, including changing all settings, and shall set all settings for proper operation of the pump station and record these initial settings on the start-up report form.

END OF SECTION

SECTION 33 4100 - SUBDRAINAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Building Perimeter Drainage Systems.

B. Filter aggregate and fabric and bedding.

1.02 RELATED REQUIREMENTS

A. Section 31 2316 - Building Excavation: Excavating for subdrainage system piping and surrounding filter aggregate.

B. Section 31 2323 - Building Fill: Backfilling over filter aggregate, up to subgrade elevation.

1.03 SUBMITTALS

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

B. Product Data: Provide data on pipe drainage products and pipe accessories.

C. Shop Drawings: Indicate dimensions, layout of piping, high and low points of pipe inverts, gradient of slope between corners and intersections.

PART 2 PRODUCTS

2.01 PIPE MATERIALS

A. Corrugated Plastic Tubing: Flexible type; 4 inch (100 mm) diameter, with required fittings.

B. Use perforated pipe at subdrainage system; unperforated through sleeved walls.

2.02 AGGREGATE AND BEDDING

A. Filter Aggregate and Bedding Material:

1. 3/4 inch clean drain rock with no fines.

2.03 ACCESSORIES

A. Pipe Couplings: Solid plastic.

B. Filter Fabric: Water pervious type, black polyolefin.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings.

3.02 PREPARATION

A. Hand trim excavations to required elevations. Correct over-excavation with material as indicated in Section 31 2323.

B. Remove large stones or other hard matter that could damage drainage piping or impede consistent backfilling or compaction.

3.03 INSTALLATION

A. Install and join pipe and pipe fittings in accordance with pipe manufacturer's instructions.

B. Place drainage pipe on clean cut subsoil.

C. Lay pipe to slope gradients noted on drawings; with maximum variation from true slope of 1/8 inch (3 mm) in 10 feet (3 m).
D. Place pipe with perforations facing down. Mechanically join pipe ends.
E. Install pipe couplings.
F. Install filter aggregate at sides, over joint covers and top of pipe. Provide top cover compacted thickness of 12 inches (300 mm).
G. Place filter fabric over levelled top surface of aggregate cover prior to subsequent backfilling operations.
H. Place aggregate in maximum 4 inch (100 mm) lifts, consolidating each lift.
I. Refer to Section 31 2323 for compaction requirements. Do not displace or damage pipe when compacting.
J. Place impervious fill over drainage pipe aggregate cover and compact.

3.04 PROTECTION

A. Protect pipe and aggregate cover from damage or displacement until backfilling operation begins.

END OF SECTION