Construction Documents 6/12/24

sfL+a
ARCHITECTS
Capital Bank Plaza
333 Fayetteville Street, Suite 225
Raleigh NC 27601

PROJECT MANUAL

VOLUME 2 (of 3)

Divisions 09 thru 23

Architect's Project Number: 02205.000

Pamlico 6-12 School
601 Main Street
Bayboro, NC 28515

Pamlico County Schools
507 Anderson Drive
Bayboro, NC 28515

June 12, 2024
Construction Document

ENERGY STAR PARTNER

Set Number: _____

Construction Documents 6/12/24

SECTION 00 01 01

PROJECT TITLE PAGE

Date

June 12, 2024
Construction Document

Project Identification

Pamlico 6-12 School
601 Main Street
Bayboro, NC 28515
Pamlico County, NC

Architect Project No.: 02205.000

Owner

Pamlico County Schools
507 Anderson Drive
Bayboro, NC 28515
Telephone: 252-745-4171

Architect

SfL+a Architects
333 Fayetteville Street, Suite 225
Raleigh, North Carolina 27601
Telephone: 919-573-6350

Structural Engineer

Bennett & Pless
5430 Wade Park Blvd, Suite 400
Raleigh, North Carolina 27607
Telephone: 919-832-5587

Fire Protection Engineer
Plumbing Engineer
Mechanical Engineer
Electrical Engineer
Fire Alarm Engineer
Technology Engineer

Optima Engineering, PA
1927 South Tryon Street, Suite 300
Charlotte, North Carolina 28203
Telephone: 704-338-1292

Civil Engineer
Landscape Architect

Crawford Design Company
116 North Cool Spring Street
Fayetteville, NC 28301
Telephone: 910-221-0033

Kitchen Equipment Designer	Foodesign Associates 220 N Ames Street, Suite 101 Matthews, NC 28105 Telephone: 704-545-6151
Roofing Engineer	REI Engineers, Inc. 9121 Anson Way, Suite 100 Raleigh, NC 27615 Telephone: 919-845-1450
Acoustical Engineer	Stewart Acoustical Consultants 7330 Chapel Hill Road, Suite 201 Raleigh, NC 27607 Telephone: 919-858-0899

END OF SECTION

SECTION 00 01 07

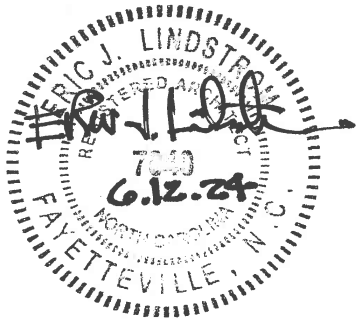
SEALS PAGE

Architect

SfL+a Architects, PA
NC Corporate Registration
NC Registration Number 50676

Architect

SfL+a Architects, PA
Eric J. Lindstrom
NC Registration Number 7040

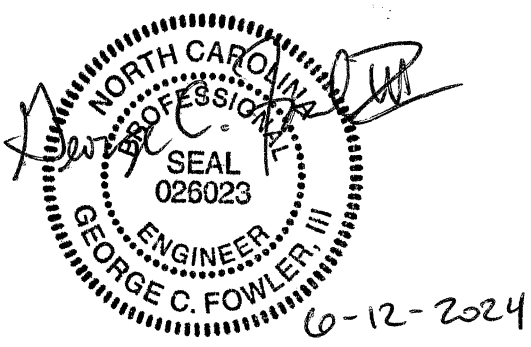


Structural Engineer

Bennett & Pless
Timothy K. Hilton
NC Registration Number 037412

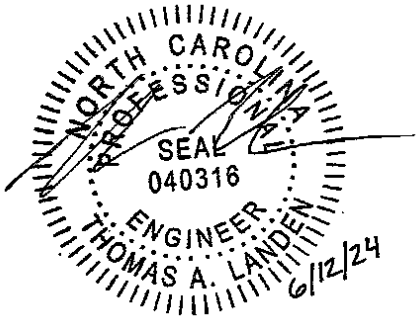
Fire Protection Engineer
Plumbing Engineer

Optima Engineering, PA
George C. Fowler III
NC Registration Number 026023



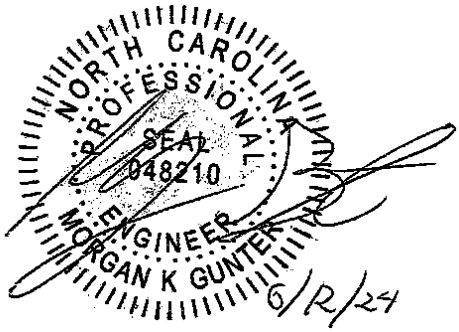
Mechanical Engineer

Optima Engineering, PA
Thomas A. Landen
NC Registration Number 040316



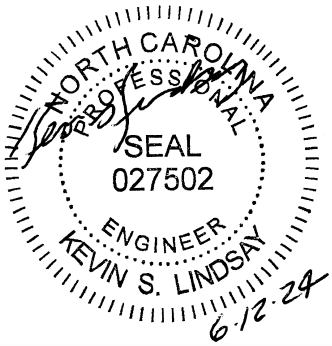
Electrical Engineer
Fire Alarm Engineer

Optima Engineering, PA
Morgan K. Gunter
NC Registration Number 048210



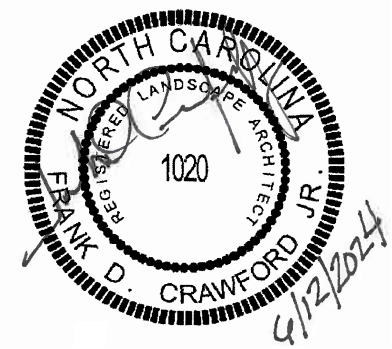
Civil - Stormwater Engineer
Civil - Utilities Engineer

Crawford Design Company
Kevin S. Lindsay
NC Registration Number 027502



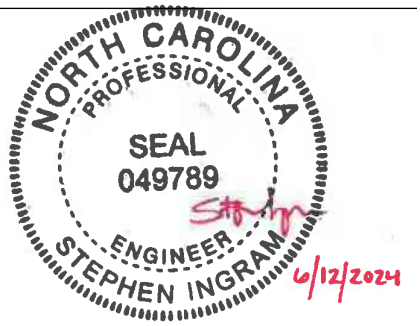
Landscape Architect

Crawford Design Company
Frank D. Crawford, Jr.
NC Registration Number 1020



Roofing Engineer

REI Engineers, Inc.
Stephen E. Ingram
NC Registration Number 049789



END OF SECTION

Construction Documents 6/12/24

SECTION 00 01 10

TABLE OF CONTENTS
Volume One *(of three)*
Divisions 00 - 08

PROCUREMENT AND CONTRACTING REQUIREMENTS GROUP

DIVISION 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS

SPECIFICATIONS GROUP

DIVISION 01 - GENERAL REQUIREMENTS

DIVISION 02

Not Used

DIVISION 03 - CONCRETE

DIVISION 08 - OPENINGS

Construction Documents 6/24/24

TABLE OF CONTENTS
Volume Two *(of three)*
Divisions 09 - 23

PROCUREMENT AND CONTRACTING REQUIREMENTS GROUP

DIVISION 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS

Refer to Project Manual Volume One for Additional Division 00 - Procurement and Contracting Requirements

SPECIFICATIONS GROUP

(Continued from Volume One)

DIVISION 01 - GENERAL REQUIREMENTS

Refer to Project Manual Volume One for Division 01 - General Requirements

DIVISION 09 - FINISHES

DIVISION 10 - SPECIALTIES

DIVISION 21 - FIRE SUPPRESSION

DIVISION 22 - PLUMBING

DIVISION 23 - MECHANICAL (HVAC)

Construction Documents 6/24/24

TABLE OF CONTENTS
Volume Three *(of three)*
Divisions 24 - 39

PROCUREMENT AND CONTRACTING REQUIREMENTS GROUP

DIVISION 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS

Refer to Project Manual Volume One for Additional Division 00 - Procurement and Contracting Requirements

SPECIFICATIONS GROUP

(Continued from Volume Two)

DIVISION 01 - GENERAL REQUIREMENTS

Refer to Project Manual Volume One for Division 01 - General Requirements

DIVISION 24 - 25

Not Used

DIVISION 26 - ELECTRICAL

DIVISIONS 34 - 39

Not Used

END OF TABLE OF CONTENTS

Construction Documents 6/24/24

SECTION 09 21 16

GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Interior Gypsum Board.
2. Exterior Gypsum Board.
3. Framing.
4. Suspension Support.
5. Acoustic Attenuation.
6. Accessories.

B. Related Requirements:
1. Section 01 33 00 – Submittal Procedures: Delegated-Design Services.
2. Section 05 40 00 - Cold-Formed Metal Framing.
3. Section 06 10 53 - Miscellaneous Rough Carpentry: Wood blocking for support of wall cabinets, toilet accessories and other wall mounted Work.
4. Section 07 21 00 - Thermal Insulation: Insulation for gypsum board assemblies requiring thermal insulation.
5. Section 07 90 00 - Joint Protection.
6. Section 09 30 00 - Tiling: For Tile Backer Board that is to be installed on framing that is provided in this Section.

1.2 REFERENCES

A. ASTM International (ASTM):
1. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
2. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members; 2015.
3. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
4. ASTM C303 - Standard Test Method for Dimensions and Density of Preformed Block and Board-Type Thermal Insulation; 2021.
5. ASTM C473 - Standard Test Methods for Physical Testing of Gypsum Panel Products; 2019.
6. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017; Reapproval 2022.
7. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2022.
8. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2018.
9. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2023.
10. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.
11. ASTM C834 - Standard Specification for Latex Sealants; 2017, Reapproval 2023.
12. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2020.
13. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2022.

14. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2022.
15. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2022.
16. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2019.
17. ASTM C1104/C1104M - Standard Test Method for Determining the Water Vapor Sorption of Unfaced Mineral Fiber Insulation; 2019.
18. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2017.
19. ASTM C1280 - Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing; 2018.
20. ASTM C1338 - Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings; 2019, Reapproval 2022.
21. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.
22. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels; 2019.
23. ASTM C1658/C1658M - Standard Specification for Glass Mat Gypsum Panels; 2019, Editorial Changes 2020.
24. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.
25. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023a.
26. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009, Reapproval 2016.
27. ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C; 2022.
28. ASTM E970 - Standard Test Method for Critical Radiant Flux of Exposed Attic Floor Insulation Using a Radiant Heat Energy Source; 2017, Editorial Changes 2022.
29. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, Editorial Changes 2021.

B. California Department of Public Health (CDPH):
   1. CDPH Standard Method VOC V1.2 - Standard Method For The Testing And Evaluation Of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers - Version 1.2; 2017.

C. Gypsum Association (GA):
   1. GA-216 - Application and Finishing of Gypsum Panel Products; 2021.
   2. GA-600 - Fire Resistance and Sound Control Design Manual; 2021.

D. International Organization for Standardization (ISO):
   1. ISO 11600 - Building Construction - Jointing Products - Classification and Requirements For Sealants; 2002, Amendments 2011.

E. Intertek Testing Services (ITS):
   1. ITS (DIR) - Directory of Listed Products; Current Edition.

F. Underwriters Laboratories Inc. (UL):
   1. UL (FRD) - Fire Resistance Directory; Current Edition.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data on metal framing; gypsum board and sheathing; joint treatment materials; and acoustic accessories.

C. Shop Drawings: Indicate special details associated with fireproofing and acoustic accessories.
   1. Show type, weight, location, and spacing of members. Clearly identify attachments and connections using AWS symbols for welds, standard designations for fasteners. Show bracing, supplemental strapping, clips, and other accessories required.
   2. Delegated Engineering Design: Shop drawings shall be sealed by a licensed Professional Structural Engineer registered in the State in which the project is located and shall include structural calculations verifying compliance with the performance data specified and as noted on the Building Code Data Sheet and Structural requirements on the Drawings. Design is to comply the provisions of the State Building Code, for the State in which the Work is constructed.
      a. Provide sealed calculations indicating that design of suspension systems provide compliance with seismic structural requirements indicated in the Performance and Design Requirements article in this Section.
      b. Verify and coordinate stud depth with the partition schedule on the Drawings. Indicate component details, framed openings, bearing, anchorage, loading, welds, seismic design components, type and location of fasteners, accessories, and items required for the Work.
      c. Show type, weight, location, and spacing of members. Clearly identify attachments and connections using AWS symbols for welds, standard designations for fasteners. Show bracing, supplemental strapping, clips, and other accessories required.

D. Samples:
   1. Submit two sets of each item indicated in ACCESSORIES article in this Section, illustrating manufacturer's full range of options. Submit for selection by Architect.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three (3) years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three (3) years documented experience.

C. Delegated Engineering Design: Design all metal stud and cold rolled steel framing using the engineering services of a Professional Structural Engineer experienced in design of this Work and licensed to perform professional engineering services in the State in which the project is located.

PART 2 PRODUCTS

2.1 PERFORMANCE AND DESIGN REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E19 by an independent testing agency.

B. Fire Rated Wall Construction: Wall assembly fire rating to be as indicated on Drawings and as required by building code.

C. Seismic Design is to comply with requirements for the Seismic Design Category as indicated on the Structural Drawings and Section 00 31 00 - Available Project Information.

D. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

2.2 MANUFACTURERS

A. Manufacturers:
1. CertainTeed Corporation (CTC).
2. Georgia-Pacific Gypsum Corporation (GPG).
3. National Gypsum Company (NGC).
4. USG Corporation (USG).
5. Substitutions: Section 01 60 00 - Product Requirements.

2.3 INTERIOR GYPSUM BOARD MATERIAL

A. Mold Resistant Gypsum Board: ASTM C1396/C1396M; paper faced; maximum available length in place; ends square cut; tapered edges; suitable for finish and paint.
1. 5/8 inch, Type X fire resistant complying with requirements of ASTM C1396/C1396M.
2. Combustibility: Noncombustible complying with ASTM E136.
3. Surface Burning Characteristics: When tested in accordance with ASTM E84.
   a. Flame Spread: 15, maximum.
   b. Smoke Development: 5, maximum.
   c. Class: Class A.
4. Water Absorption: 5 percent maximum by weight after two-hour immersion when tested in accordance with ASTM C473.
5. Mold Growth Resistance: Score of 10 minimum, in accordance with ASTM D3273 for mold growth on interior coatings surface.
6. Finish Level: Refer to Finish Levels Schedule at end of this Section.
7. Basis of Design:
   a. USG - Sheetrock Mold Tough Firecode X.
8. Locations: All interior gypsum surfaces in the following areas unless indicated otherwise on Drawings.
   a. All interior gypsum surfaces where no other gypsum board type is indicated.

B. Abuse and Mold Resistant Gypsum Board: ASTM C1396/C1396M; paper faced; maximum available length in place; ends square cut; tapered edges; suitable for finish and paint.
1. 5/8 inch, Type X fire resistant complying with requirements of ASTM C1396/C1396M.
2. Combustibility: Noncombustible complying with ASTM E136.
3. Surface Burning Characteristics: When tested in accordance with ASTM E84.
   a. Flame Spread: 15, maximum.
   b. Smoke Development: 5, maximum.
   c. Class: Class A.
4. Water Absorption: 5 percent maximum by weight after two-hour immersion when tested per ASTM C473.
5. Mold Resistance: Score of 10 minimum, in accordance with ASTM D3273 for mold growth on interior coatings surface.
6. Finish Level: Refer to Finish Levels Schedule at end of this Section.
7. Basis of Design:
   a. USG - Sheetrock Mold Tough AR Firecode X.
      1) Surface Abrasion: Level 2 minimum, per ASTM C1629/C1629M.
      2) Indentation: Level 1 minimum, per ASTM C1629/C1629M.
      3) Soft Body Impact: Level 2 minimum, per ASTM C1629/C1629M.
      4) Hard Body Impact: Level 1 minimum, per ASTM C1629/C1629M.
8. Locations: All interior gypsum surfaces in the following areas unless indicated otherwise on Drawings.

a. All classrooms and rooms of instruction and teaching; minimum height from finish floor to 8 feet above finish floor unless otherwise indicated on Drawings.
b. Media Center and Learning Commons Areas; minimum height from finish floor to 8 feet above finish floor unless otherwise indicated on Drawings.
c. All circulation areas, corridors, and passageways; minimum height from finish floor to 8 feet above finish floor unless otherwise indicated on Drawings.
d. Toilet Areas WITHOUT contiguous shower stalls.
e. Kitchen Food Preparation Areas.
f. Kitchen Food Storage Areas.
g. Food Serving Areas.
h. Dish Washing Area.
i. Janitor And Custodian Closets.

2.4 EXTERIOR GYPSUM BOARD MATERIAL

A. Exterior Fiberglass Faced Sheathing Gypsum Board: ASTM C1177/C1177; glass mat faced gypsum substrate; maximum available length in place; tapered edges.
1. 5/8 inch, Type X fire resistant complying with requirements of ASTM C1177/C1177M.
2. Combustibility: Noncombustible complying with ASTM E136.
3. Surface Burning Characteristics: When tested in accordance with ASTM E84.
a. Flame Spread: Zero.
b. Smoke Development: Zero.
c. Class: Class A.
4. At Assemblies Indicated with Fire-Rating: Use type required by indicated tested assembly. If no tested assembly is indicated, use Type X board, UL (FRD) or ITS (DIR) listed.
5. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
6. Fungal Resistance: No fungal growth when tested in accordance with ASTM G21.
7. Basis of Design:
a. USG - Securock Glass-Mat Sheathing Firecode X.
8. Locations: Exterior sheathing unless indicated otherwise on Drawings.

2.5 FRAMING MATERIAL

A. Thicknesses provided here are minimum and subject to increase by Delegated Engineer's design requirements.
1. Studs: ASTM C645; galvanized sheet steel.
a. 0.0312 inch thick, C shape.
2. Runners and Tracks: ASTM C645; galvanized sheet steel.
a. 0.0312 inch thick, C shape.
3. Furring, Framing, and Accessories: ASTM C645; galvanized sheet steel.
a. 0.0312 inch thick, C shape.
4. Shaft Wall Studs and Accessories: ASTM C645; galvanized sheet steel.
a. 0.0312 inch thick, C shape.

B. Galvanizing: Comply with ASTM A653/A653M zinc-coated hot dipped galvanized steel.
1. Interior Framing: G40.
2. Exterior Framing: G60.

C. Framed Partition Head To Structure Connections: Provide one of the following types and coordinate to provide fire rated constructed assemblies as indicated on Drawings.
1. Single Long-Leg Runner System: ASTM C645 top runner with 2-inch- deep flanges in thickness not less than indicated for studs, installed with studs friction fitted into top runner and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.

2. Double-Runner System: ASTM C645 top runners, inside runner with 2-inch-deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
3. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

D. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding strength, and other properties required to fasten steel members to substrates. Use screws with low profile head where board, or other overlay sheathing, is to be applied.

E. Anchorage to Substrate: Provide tie wire, fasteners, screws, metal supports, and other anchorage devices, of type and size to suit application, and to secure materials to building structural elements.

2.6 SUSPENSION SUPPORT MATERIAL

A. Suspension Systems: ASTM C635/C635M heavy-duty main beam classification; ASTM A653/A653M zinc-coated hot dipped galvanized steel; ASTM C645 Standard specification for rigid furring channels for screw application of gypsum board.

B. Accessories: Stabilizer bars, clips, splices, and perimeter moldings required for suspended grid system.

C. Support Channels and Hangers: Primed steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

2.7 ACOUSTIC ATTENUATION MATERIAL

A. Acoustic Attenuation Insulation: Install at interior walls and ceilings as indicated on Drawings.
1. Mineral Wool Batt Insulation: Flexible or semi-rigid preformed batt or blanket, complying with ASTM C665; friction fit.
   a. Unfaced Type: ASTM C665 Type-I (unfaced).
   b. Combustibility: Noncombustible complying with ASTM E136.
   c. Surface Burning Characteristics: When tested in accordance with ASTM E84.
      1) Flame Spread: 25, maximum.
      2) Smoke Development: 50, maximum.
   d. Fungi Resistance: Passes when tested in accordance with ASTM C1338.
   e. Nominal Density: Minimum 2.5 pcf when tested in accordance with ASTM C303.
   f. Corrosivity to Steel: Passes when tested in accordance with ASTM C665.
   g. Blanket Width: Sized to fully friction fit space between framing members.
   h. Blanket Thickness: Sized to fully friction fit cavity, but not less than 3-1/2 inches.
   i. Manufacturers:
      1) Johns Manville.
      2) Knauf Insulation.
      3) Owens Corning.
      4) Rockwool.

B. Acoustic Sealant: For exposed and concealed joints and annular spaces around through-penetrations. Type to be non-sag, paintable, non-staining latex sealant complying with ASTM C834, ASTM C919 and as follows:
1. Sealant to reduce airborne sound transmission through head-of-wall and bottom-of-wall joints and openings to accommodate through-penetrations in building construction as demonstrated by testing representative assemblies in accordance with ASTM E90.
2. Sound Transmission Class: Sealant to maintain STC ratings at sound rated partitions as indicated on the drawings.

3. Surface Burning Characteristics: When tested in accordance with ASTM E84.
   a. Flame Spread: 10, maximum.
   b. Smoke Development: 10, maximum.
4. Mold and Mildew Resistance: Rating of zero (0), "no growth", in accordance with ASTM G21.
5. Movement Capability: 10 percent minimum, in accordance with ISO 11600.
6. Sealant materials and methods shall conform to applicable governing codes and authorities having jurisdiction.
7. Maximum volatile organic compound content to be in accordance with CDPH Standard Method VOC V1.2.
8. Basis of Design: As indicated on Drawings.

C. Acoustic Sprays: For exposed and concealed locations; sprayable latex material complying with ASTM C919 and the following:
1. Spray to reduce airborne sound transmission through head-of-wall joints in building construction as demonstrated by testing representative assemblies in accordance with ASTM E90.
2. Sound Transmission Class: Spray to maintain STC ratings at sound rated partitions as indicated on the drawings.
3. Surface Burning Characteristics: When tested in accordance with ASTM E84.
   a. Flame Spread: 10, maximum.
   b. Smoke Development: 10, maximum.
4. Mold and Mildew Resistance: Rating of zero (0), "no growth", in accordance with ASTM G21.
5. Movement Capability: 10 percent minimum, in accordance with ISO 11600.
6. Spray materials and methods shall conform to applicable governing codes and authorities having jurisdiction.
7. Maximum volatile organic compound content to be in accordance with CDPH Standard Method VOC V1.2.
8. Basis of Design: As indicated on Drawings.

2.8 ACCESSORIES

A. Finishing Trim: To be metal conforming to ASTM A653/A653M, ASTM A1003/A1003M, ASTM C1047, unless otherwise indicated. Includes trims such as corner beads, edge trim, control joints and expansion joints.
1. Types: As detailed or required for finished appearance.
   a. Continuous finishing bead profile required for termination and protection of gypsum board finish compound edge.
   b. J-trim, without bead, is not permitted at gypsum board termination edge unless indicated on Drawings.
2. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead at exposed panel edges.

B. Rigid Vinyl: Vinyl trim permitted only as follows, or where noted as vinyl on Drawings.
1. Gypsum Board Termination at Dissimilar Surface: L-trim with tear-away strip.
   a. Manufacturers:
      1) Trim-Tex - Tear Away L-Bead.
      2) Phillips Manufacturing Company - GripStik L-Tear.
      3) MarinoWare - L-Tear Strip

C. Expansion Joints:
1. Type: Accordion profile with factory-installed protective tape.

D. Control Joints:
1. Type: V-shaped metal with factory-installed protective tape.

E. Joint Materials: ASTM C475/C475M; reinforcing tape, joint compound, and water.
   1. Joint Tape:
      a. Fiberglass Tape: 2 inch (50 mm) wide, open-weave coated glass fiber tape for joints and corners, except as otherwise indicated.
   2. Joint Compound:
      a. Drying-Type: Vinyl-based, ready-mixed.

F. Screws for Fastening Board Materials to Steel Framing Members:
   1. Gypsum Board: Use S-Type screws complying with the following.
      a. Metal thickness from 0.033 to 0.112 inch: ASTM C954; steel drill screws, corrosion resistant.
      b. Metal thickness less than 0.033 inch: ASTM C1002; self-piercing tapping screws, corrosion resistant.

G. Exterior Soffit Vents: One piece, perforated, ASTM B221 6063 T5 alloy aluminum, with edge suitable for direct application to gypsum board and manufactured especially for soffit application. Provide continuous vent unless otherwise indicated on Drawings.
   1. Finish and color to be selected by Architect for manufacturer's full range.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 73 00 - Execution: Verification of existing conditions before starting work.

B. Verify site conditions are ready to receive work and opening dimensions are as indicated on shop drawings.

3.2 PREPARATION

A. Section 01 73 00 - Execution: Prepare field conditions and existing construction for installation of work of this Section.

B. Prepare materials to be installed and equipment to be used during installation.

3.3 INSTALLATION - GENERAL

A. Section 01 73 00 - Execution: Related to installation of Work.

B. Installation requirements in this Section are minimum requirements and are subject to more stringent requirements as may be indicated in the design by the Delegated Engineering Design.

C. SUPPORT AND ANCHOR FRAMING SYSTEMS TO FLOOR SYSTEM BELOW AND BUILDING STRUCTURAL MEMBERS ABOVE. DO NOT SUSPEND, SUPPORT, OR ANCHOR FRAMING SYSTEMS TO NON-STRUCTURAL BUILDING ELEMENTS ABOVE SUCH AS ROOF DECKING AND FLOOR DECKING. DO NOT ALLOW ANCHORS OR SUPPORTS TO TOUCH OR DAMAGE EMBEDDED, CONCEALED OR VISIBLE WORK SUCH AS HVAC, ELECTRICAL, AND PLUMBING COMPONENTS.

D. Environmental Limitations: Install gypsum board, joint treatment materials, finish materials, and adhesives in accordance with ASTM C840 requirements and gypsum board manufacturer's written recommendations.

E. Do not install panels that are wet, moisture damaged, or mold damaged.
   1. Indications that panels are wet, or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

3.4 METAL FRAMING INSTALLATION

A. Install metal framing in accordance with GA-216, GA-600, ASTM C754, and manufacturer's recommendations.

B. Wall Framing:
1. Metal stud spacing to be 16 inches on center, minimum.
2. Refer to Drawings for indication of partitions extending stud framing through ceiling to structure above. Maintain clearance under structural building members to avoid deflection transfer to studs. Provide extended leg ceiling runners.
3. Door Opening Framing: Reinforce openings as required for to withstand the forces imposed by the weight and operation of specified doors or operable panels, using not less than double studs at jambs and increased reinforcing as needed.
4. Blocking: Screw wood blocking to studs. Install blocking as required for support of wall mounted construction, devices, and equipment similar to, but not limited to, the following:
   a. Toilet partitions and accessories; cabinet units; visual display surfaces; televisions and monitors; handrails; fixtures.

C. Wall Furring:
1. Erect wall furring for direct attachment to concrete masonry walls.
2. Erect furring channels vertically; space maximum 24 inches o.c., not more than 4 inches from abutting walls. Secure in place on alternate channel flanges at maximum 24 inches on center.
3. Erect metal stud framing spaced 1/2 inches from concrete masonry walls, attached by adjustable furring brackets.
4. Wall Furring for Fire Ratings: Install furring as required for fire resistance ratings indicated and to GA-600 requirements.

D. Ceiling Framing:
1. Coordinate location of hangers with other work.
2. Install ceiling framing independent of walls, columns, and above ceiling work.
3. Reinforce openings in ceiling suspension system which interrupt main carrying channels or furring channels, with lateral channel bracing. Extend bracing minimum 24 inches past each end of openings.
4. Laterally brace entire suspension system.

3.5 ACOUSTIC ACCESSORIES INSTALLATION

A. Install acoustic accessories in accordance with GA-600 as related to sound control.

B. Acoustic Attenuation Insulation: Friction fit insulation within framing cavity in partitions tight within spaces, around cut openings, behind and around electrical and mechanical items within or behind partitions, and tight to items passing through partitions. Thickness as required to fill cavity.

C. Acoustic Sealant and Spray:
1. General: Comply with Drawings and acoustic sealant and spray manufacturer’s written installation instructions for products and applications indicated.
2. Standards: Comply with recommendations of ASTM C919 for use of joint sealants in acoustical applications as applicable to materials, applications and conditions indicated.
3. Install acoustic sealant backings of type indicated to support sealant and spray during application in accordance with manufacturer’s written installation instructions.

4. Install acoustic sealant and spray free of air pockets, embedded foreign matter, sags and ridges.
5. Tooling of Non-sag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
    a. Remove excess acoustic sealant from surfaces adjacent to joint.
    b. Remove excess acoustic spray from surfaces adjacent to joint as indicated on the drawings.
    c. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
    d. Provide concave joint configuration unless otherwise indicated.

3.6 GYPSUM BOARD INSTALLATION

A. Install gypsum board in accordance with ASTM C840, and GA-216.

B. Gypsum Board:
1. Use screws when fastening gypsum board to metal furring or framing.
2. Erect single layer gypsum board in most economical direction, with ends and edges occurring over firm bearing. Exception as follows:
    a. Erect single layer fire rated gypsum board vertically, with edges and ends occurring over firm bearing.
3. Erect exterior gypsum sheathing in accordance with ASTM C1280, horizontally, with edges butted and ends occurring over firm bearing.
4. Double Layer Applications: Secure second layer to first with fasteners. Place second layer parallel to first layer. Offset joints of second layer from joints of first layer.
5. Treat cut edges and holes in moisture resistant gypsum board and exterior gypsum soffit board with sealant.
6. Control Joints: Construct control joint in accordance with the drawings, GA-216, and as follows:
    a. Place control joints consistent with lines of building space and features. When not indicated in the drawings, install control joints per GA-216 and as follows:
        1) Not more than 30 feet apart on walls over 50 feet long.
        2) At ceilings, not more than 30 feet apart in both directions.
        3) At interior and exterior gypsum and stucco soffits and bulkheads, at all inside corners of vertical surfaces not more than 30 feet apart on vertical and horizontal surfaces. Control joints installed on vertical surfaces shall continue, in alignment/direction and through corner finish, onto contiguous horizontal surface of like material (like treatment from horizontal surfaces to contiguous vertical surfaces).
        4) At interior and exterior soffits and bulkheads, not more than 30 feet apart on vertical and horizontal surfaces. Control joints installed on vertical surfaces shall continue, in alignment/direction and through corner finish, onto contiguous horizontal surface of like material (like treatment from horizontal surfaces to contiguous vertical surfaces).
7. Place corner beads at external corners. Use longest practical length.
8. Edge Trim: Install LC Bead edge trim at locations where gypsum board abuts dissimilar materials. Allow appropriate space for application of appropriate sealant to seal and bridge between the gypsum finished edge trim and the dissimilar material.
9. Exterior Soffit Vents: Install according to manufacturer's written instructions and in locations shown on the drawings. Provide vent area indicated.

3.7 JOINT TREATMENT AND FINISH

A. Finish gypsum board materials in accordance with ASTM C840 and to Finish Level as indicated in Schedule at end of this Section.

B. Fiberglass Joint Tape: Embed and finish with setting-type joint compound in the following locations and as otherwise recommended by board manufacturer for application conditions.
   1. Exterior Locations: All exterior locations.
   2. Interior Locations: Tile backer board locations.
   3. All Glass Mat Faced Board Locations: Interior and exterior.

C. Paper Joint Tape: Embed with drying-type joint compound and finish with drying-type joint compound.in the following locations.
   1. Exterior Locations: No paper joint tape to be used.
   2. Interior Locations: To be used at locations where fiberglass joint tape is not indicated.

D. Tape, fill and sand joints, edges and corners, ready to receive finishes.

E. Glass Mat Faced Gypsum Board Surfaces:
   1. Use fiberglass joint tape, embed and finish with setting type joint compound.
   2. Provide full surface skim coat finishing as required to conceal and prevent telegraphing of glass mat texture, resulting in a smooth surface finish.

3.8 SHAFT WALL INSTALLATION

A. Install in accordance with manufacturer's installation instructions, GA-216, GA-600, and ASTM C754.

B. Fasten runners to structure with short leg to finished side, using appropriate power-driven fasteners at not more than 24 inches on center.

C. Install studs at spacing required to meet performance requirements.

D. Shaft Wall Liner: Cut panels to accurate dimension 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.

3.9 ERECTION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation of Finished Gypsum Board Surface from Flat Surface: 1/8 inch in 10 feet in any direction.

3.10 SCHEDULES

A. Finish Levels Schedule: Gypsum finish levels to be in accordance with ASTM C840:
   1. Level 1: Surfaces above finished ceilings and concealed from view.
   2. Level 5: All surfaces exposed to view (includes GWB that is painted or covered with adhered wall covering sheet materials).

END OF SECTION

Construction Documents 6/12/24

SECTION 09 27 13

GLASS-FIBER-REINFORCED GYPSUM FABRICATIONS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Glass fiber reinforced gypsum fabrications for interior applications.

B. Related Requirements:
   1. Section 09 21 16 - Gypsum Board Assemblies: Metal support framing and materials for finishing gypsum fabrications.
   2. Section 09 90 00 - Painting and Coating: Painting gypsum fabrications.

1.2 REFERENCES

A. ASTM International (ASTM):
   1. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
   2. ASTM C473 - Standard Test Methods for Physical Testing of Gypsum Panel Products; 2019.
   3. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017, Reapproval 2022.
   4. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2023.
   5. ASTM C947 - Standard Test Method for Flexural Properties of Thin-Section Glass-Fiber-Reinforced Concrete (Using Simple Beam With Third-Point Loading); 2003, Reapproval 2023.
   6. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2022.
   7. ASTM C1355/C1355M - Standard Specification for Glass Fiber Reinforced Gypsum Composites; 1996, Reapproval 2020.
   8. ASTM C1381/C1381M - Standard Specification for Molded Glass Fiber Reinforced Gypsum Parts; 2023.
   9. ASTM C1467/C1467M - Standard Specification for Installation of Molded Glass Fiber Reinforced Gypsum Parts; 2000, Reapproval 2021.
   10. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics; 2023.
   11. ASTM D696 - Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between - 30°C and 30°C with a Vitreous Silica Dilatometer; 2016.
   12. ASTM D2583 - Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor; 2013a.
   13. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

1.3 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

B. Coordinate work with substrate construction for installation of blocking at attachment points.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data for fabrications, framing, anchors, gypsum materials, and accessories.

C. Shop Drawings: Indicate installation locations, fabrication details, weights, connection and installation details, dimensions, joint treatment types, and relationship to adjacent materials.

D. Manufacturer's Installation Instructions: Submit manufacturers written installation instructions.

E. Manufacturer's certification statement.

F. Installer's certification statement.

1.5 QUALITY ASSURANCE

A. Sole Source: Obtain gypsum fabrications from single source.

1.6 QUALIFICATIONS

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this Section with minimum five (5) years documented experience.

B. Installer Qualifications: Company specializing in performing work of this Section and with minimum five (5) years documented experience.

1.7 MOCK-UPS

A. Section 01 40 00 - Quality Requirements: Mock-up requirements.

B. Construct mockup of one full size column cover illustrating full pattern, corner and running joints, and surface finish.
   1. Locate where directed by Architect.
   2. Incorporate accepted mockup as part of Work.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Deliver products in manufacturer's original packaging. Inspect product upon receipt and report damaged material immediately to delivering carrier and note such damage on the carrier's freight bill of lading.

C. Store materials in a dry, protected, well-vented area and in accordance with manufacturer's recommendations.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Requirements before, during, and after the work.

B. Achieve and maintain work environment conditions for temperature, humidity, and protection against weather as recommended by manufacturer of products.

1.10 WARRANTY

A. Section 01 77 00 - Closeout Procedures: Product warranties.

B. Manufacturer's Warranty: Provide manufacturer's one (1) year warranty for materials and workmanship to be free of defects. Manufacturer agrees to provide matching repair or new

replacement at no charge. Warranty duration to begin with the date of Substantial Completion.

C. Installer's Warranty: Provide installer's one (1) year warranty for materials and workmanship to be free of defects. Installer agrees to provide matching repair or new replacement at no charge. Warranty duration to begin with the date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers:
1. Castle Access Panels & Forms, Inc.
2. Casting Designs, Inc.
3. CastWorks, by Armstrong World Industries, Inc.
4. Formglas Inc.
5. GRG Technologies, Inc.
6. Stromberg Architectural Products, Inc.
7. Substitutions: Section 01 60 00 - Product Requirements.

B. Glass-Fiber-Reinforced Gypsum Fabrications: Molded glass fiber reinforced gypsum fabrications with embedded integral metal support framing, and connection devices.
1. Applications: Interior applications only.
   a. Shapes, designs, and configurations indicated on Drawings.
   b. Column Covers.
2. Method of Construction: Hand or spray lay-up process in molds.
3. Material Characteristics: Complying with ASTM C1355/C1355M.
4. Glass Content: Minimum 5 percent by weight.
5. Gypsum Density: 103 to 112 pcf.
6. Flexural Strength: 3000-4000 psi in accordance with ASTM C947.
7. Compressive Strength: 7600 psi.
8. Coefficient of Linear Thermal Expansion in accordance with ASTM D696.
9. Humidified Deflection: 1/8 inch (3 mm) in accordance with ASTM C473.
10. Hardness (Barcol): No less than 75 in accordance with ASTM D2583.
11. Impact Resistance 8.0 ft.lb. per square inch in accordance with ASTM D256.
12. Surface Burning Characteristics: Class A; tested in accordance with ASTM E84.
    a. Flame spread index of 0 (zero), smoke developed index of 10, maximum,
13. Shell Thickness: 1/4 inch (6 mm), minimum.
14. Shell Thickness at Part Edges and at Fastening Points: 5/16 inch (8 mm), minimum.
15. Outside Corner Radius: 1/8 inch (3 mm), maximum.
16. Draft Angle: 3 degrees, minimum, on returns, setbacks, reveals, and grooves.
17. Tape Joint Conditions: Taper each side of joint allowing joint tape and joint compound application and finish to smooth transition.
18. Dimensional Tolerances of Molded Surfaces:
    a. Straightness: Maximum of 1/8 inch in 8 linear feet (1 mm in 750 mm) variation from straight at any point along any plane, edge, or surface.
    b. Overall Width and Length: Plus or minus 1/8 inch (3 mm).
    c. Warpage: Plus/minus 1/16 inch (2 mm).
19. Joint Cement: Type recommended by fabrication manufacturer.
20. Joint Tape and Compound: Types recommended by fabrication manufacturer, complying with ASTM C475/C475M.

2.2 FRAMING MATERIALS

A. Metal Framing: ASTM A653/A653M; Grade 33 sheet steel, cold rolled to channel shape.
   1. Minimum Thickness: 20 gauge.
   2. Depth: As required.
   3. Finish: Galvanize to G90 coating class.

2.3 ACCESSORIES

A. Embeds: Manufacturer's standard, non-corroding type.

B. Joint Materials: As recommended by fabrications manufacturer.

C. Gypsum Board Screws: ASTM C1002; length to suit application.

D. Screws for Steel Framing: Type S.

E. Anchors: Expansion bolts, powder actuated fasteners, and other fasteners of type and size to suit application; to rigidly secure materials in place.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 73 00 - Execution: Verification of existing conditions before starting work.

B. Verify that field measurements are as required.

C. Verify that surfaces and conditions are ready to accept the Work of this Section.

D. Examine products to be installed for damage and other conditions detrimental to completion of the Work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Section 01 73 00 - Execution: Related to installation of Work.

B. Install Work in accordance with manufacturer’s recommendations and ASTM C1467/C1467M.

C. Install gypsum fabrications level and plumb, without damage to shape or finish.

D. Align gypsum fabrications with adjacent construction to produce uniform horizontal and vertical joints as erection progresses.

E. Secure fabrications to substrate. Countersink, fill and finish fasteners.

F. Replace or repair damaged fabrications.

G. Surface Finish: Finish to follow shape of fabricated product. Provide smooth transition between adjacent sections.
   1. Finish levels to be in accordance with ASTM C840:
      a. Level 5: All surfaces exposed to view (includes surfaces that are to be painted or covered with adhered wall covering sheet materials).

H. Finish paint fabrications as specified in Section 09 90 00.

3.3 ERECTION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Variation from Plumb: Not more than 1/8 inch in 10 feet or 1/4 inch in 20 feet or more.

C. Variation from Level: Not more than 1/8 inch in 10 feet or 1/4 inch in 20 feet, or 3/8 inch maximum.

D. Variation in Joint Width: Not more than 1/8 inch in 36 inches or 1/4 of nominal joint width, whichever is less.

E. Variation in Plane Between Adjacent Surfaces (Lipping): Not more than 1/16 inch difference between planes of adjacent units or adjacent surfaces indicated to be flush with units.

3.4 CLEANING

A. Section 01 73 00 - Execution and Section 01 77 00 - Closeout Procedures.

B. Clean installed Work in accordance with manufacturer's recommendations including cleaning procedures and materials.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 73 00 - Execution: Protecting installed construction.

B. Protect installed construction from damage and unauthorized tampering.

END OF SECTION

Construction Documents 6/12/24

SECTION 09 30 00

TILING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Floor Tile and setting applications.
2. Wall Tile and setting applications.
3. Trim and accessories.
4. Accessories.

B. Related Requirements:
1. Section 03 30 00 - Cast-In-Place Concrete: Substrate for floor tile.
2. Section 04 20 00 - Unit Masonry: Substrate for wall tile.
3. Section 09 21 16 - Gypsum Board Assemblies: Framing and support construction for installation of tiling backer board specified in this Section.

1.2 REFERENCE STANDARDS

A. American National Standards Institute (ANSI):
1. ANSI A108/A118/A136 - Installation of Ceramic Tile; 2021:
   a. Includes ANSI A108.01, .02, .1A, .1B, .1C, .4, .5, .6, .8, .9, .10, .11, .12, .13, .14, .15, .16, .17, .18, and 21 - defines the installation of ceramic tile.
      1) ANSI A108.1A - Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar.
      2) ANSI A108.1B - Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar.
      3) ANSI A108.11 - Interior Installation of Cementitious Backer Units.
      4) ANSI A108.13 - Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone.
      5) ANSI A108.17 - Installation of Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone.
   b. Includes ANSI A118.1, .3, .4, .5, .6, .7, .8, .9, .10, .11, .12, .13, .15, .16, and ANSI A136 - defines the test methods and physical properties for ceramic tile installation materials.
      1) ANSI A118.1 - Dry-Set Cement Mortar.
      2) ANSI A118.3 - Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive.
      3) ANSI A118.4 - Modified Dry-Set Cement Mortar
      4) ANSI A118.5 - Chemical Resistant Furan Mortars and Grouts for Tile Installation.
      5) ANSI A118.6 - Standard Cement Grouts for Tile Installation.
      6) ANSI A118.7 - High Performance Cement Grouts for Tile Installation.
      7) ANSI A118.8 - Modified Epoxy Emulsion Mortar/ Grout.
      8) ANSI A118.9 - Test Methods and Specifications for Cementitious Backer Units.
      9) ANSI A118.10 - Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation.
      10) ANSI A118.11 - EGP (Exterior Glue Plywood) Modified Dry-Set Mortar.

11) ANSI A118.12 - Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation.
12) ANSI A118.15 - Improved Modified Dry-Set Cement Mortar.
13) ANSI A136.1 - Organic Adhesives for installation of Ceramic Tile.

2. ANSI A137.1 - Standard Specification for Ceramic Tile; 2022.
3. ANSI A137.2 - Standard Specifications for Glass Tile; 2022.

B. ASTM International (ASTM):
1. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2022.
2. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete; 2020.
3. ASTM C373 - Standard Test Methods for Determination of Water Absorption and Associated Properties by Vacuum Method for Pressed Ceramic Tiles and Glass Tiles and Boil Method for Extruded Ceramic Tiles and Non-tile Fired Ceramic Whiteware Products; 2018, Reapproval 2023.
4. ASTM C650 - Standard Test Method for Resistance of Ceramic Tile to Chemical Substances; 2020.
5. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2022.
6. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2022.
7. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel; 2018.
8. ASTM C1278/C1278M - Standard Specification for Fiber-Reinforced Gypsum Panel; 2017.
9. ASTM C1325 - Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units; 2022.
10. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.
11. ASTM D2394 - Standard Test Methods for Simulated Service Testing of Wood and Wood-Based Finish Flooring; 2017, Reapproval 2022.
12. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.
13. ASTM D4397 - Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications; 2016.
14. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023a.
15. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2022, Editorial Changes 2023.
16. ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C; 2022.
17. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, Editorial Changes 2021.

C. Tile Council of North America (TCNA):
1. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2023.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this Section; require attendance by all affected installers.

1.4 SUBMITTALS

A. See Section 01 33 00 - Submittal Procedures, for submittal procedures.

B. Product Data: Provide manufacturer's data sheets on tile, mortar, grout, and accessories. Include manufacturer's recommendations for using installation of system components including, but not limited to, tile, setting materials, accessories, trim, grouts, and adhesives.

C. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, trim shapes and locations, junctions with dissimilar materials, control and expansion joints, termination edge conditions, accessories, areas receiving waterproofing membrane, and setting details.

D. Samples for Initial Selections: Two manufacturer's complete set of color samples illustrating the full range of finishes, textures, and colors available for each product; submit for Architect's initial selections.

E. Samples for Verification: From the Architect's initial selections, prepare and submit two samples for each selected finish, texture, and color; samples to be same product material type indicated for final Work; each sample 12 x 12 inches. Where finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.

F. Samples for Verification of Products Indicated On Drawings: Prepare and submit two samples for each selected finish, texture and color; samples to be same product material type indicated for final Work; each sample to be actual size required for work. Where finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.

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

1.5 CLOSEOUT SUBMITTALS

A. Section 01 78 23 - Operation and Maintenance Data.

B. Operation and Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods. Include recommended polishes, waxes and other restorative/protective products and methods.

1.6 QUALITY ASSURANCE

A. Perform work in accordance with ANSI A108/A118/A136 and TCNA (HB).

B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this Section, with minimum ten (10) years of documented experience.

C. Installer Qualifications: Company specializing in performing tile installation, with minimum of five (5) years of documented experience.

D. Prior to grouting, prepare and protect the finish surfaces of tile work as needed to prevent staining of tile work during the grouting process and cleanup. Tile work that is stained by grout or other material is not acceptable tile work.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Protect adhesives and other temperature sensitive materials from freezing or overheating in accordance with manufacturer's instructions.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Do not install solvent-based products in an unventilated environment.

B. Maintain ambient and substrate temperature of 50 degrees F (10 degrees C) during installation of mortar materials.

1.9 SPARE PARTS AND MAINTENANCE PRODUCTS

A. Section 01 60 00 - Product Requirements: Extra materials, spare parts, and maintenance products.
   1. Five percent (5%) full size units of each product type, size, color, shape, profile, and surface finish combination installed, but no less than the following:
      a. Twenty (20) square feet of field tiles.
      b. Five (5) units of each trim and accessory.
      c. Sixteen (16) linear feet of each type and color non-ceramic trim.
      d. Sixteen (16) linear feet of threshold.

PART 2 PRODUCTS

2.1 TILE

A. Manufacturers: All products of each type by the same manufacturer.
   1. Crossville Tile Company: www.crossvilleinc.com.
   2. Daltile Corporation: www.daltile.com.
   3. Trinity Tile: www.trinitytile.com.
   4. Other manufacturers as may be indicated on Drawings.
   5. Substitutions: Section 01 60 00 - Product Requirements.

B. Porcelain Floor Tile: ANSI A137.1, Standard Grade.
   1. Moisture Absorption: 0.5 to 3.0 percent, tested in accordance with ASTM C373.
   2. Basis of Design:
      a. As indicated on Drawings.
   3. Colors:
      a. As indicated on Drawings.
   4. Grout Joints Size:
      a. As recommended by manufacturer.
   5. Sizes:
      a. As indicated on Drawings.
      b.
   6. Thickness: As indicated on Drawings, but not less than 3/8 inch.
   7. Shapes:
      a. As indicated on Drawings.
   8. Edges:
      a. As indicated on Drawings.
   9. Surface Finishes:
      a. As indicated on Drawings.
   10. Patterns:
      a. As indicated on Drawings.
   11. Tile Trim: Refer to TRIM AND ACCESSORIES article in this Section.

C. Porcelain Wall Tile: ANSI A137.1, Standard Grade.
   1. Moisture Absorption: 0.5 to 3.0 percent, tested in accordance with ASTM C373.
   2. Basis of Design:
      a. As indicated on Drawings.
   3. Colors:
      a. As indicated on Drawings.

4. Grout Joints Size:
   a. As recommended by manufacturer.
5. Sizes:
   a. As indicated on Drawings.
6. Thickness: As indicated on Drawings, but not less than 3/8 inch.
7. Shapes:
   a. As indicated on Drawings.
8. Edges:
   a. Cushioned, unless indicated otherwise on Drawings.
   b. As indicated on Drawings.
9. Surface Finishes:
   a. As indicated on Drawings.
10. Patterns:
    a. As indicated on Drawings.
11. Tile Trim: Refer to TRIM AND ACCESSORIES article in this Section.

D. Ceramic Wall Tile: ANSI A137.1, Standard Grade.
1. Moisture Absorption: 7.0 to 20.0 percent, tested in accordance with ASTM C373.
2. Basis of Design:
   a. As indicated on Drawings.
3. Colors:
   a. As indicated on Drawings.
4. Grout Joints Size:
   a. As recommended by manufacturer.
5. Sizes:
   a. As indicated on Drawings.
6. Thickness: As indicated on Drawings, but not less than 1/4 inch.
7. Edges:
   a. Cushioned, unless indicated otherwise on Drawings.
8. Surface Finishes:
   a. As indicated on Drawings.
9. Patterns:
   a. As indicated on Drawings.
10. Tile Trim: Refer to TRIM AND ACCESSORIES article in this Section.

2.2 TRIM AND ACCESSORIES

A. Wall Tile Trim Units:
1. Top Open Edges: Bullnosed open edge

2. Inside Corners:
   a. Miter.
3. Outside Open Corners: Schluter – Quadec
4. Same manufacturer and color as wall tile type.
5. Coordinate tile size with size of wall tile type.

B. Base Tile Trim Units - For Porcelain Floor Tile and with no wall tile above:
1. Edge trim and other details to be as indicated on Drawings.
2. Top Open Edges: Bullnosed open edge.
3. Bottom:
   a. Straight joint to floor.
4. Inside Corners:
   a. Miter.
5. Outside Open Corners:
   a. Bullnosed open edge and bottom to be straight joint to floor.

6. Same manufacturer and color as floor tile type.
7. Lengths and Joints:
   a. Match lengths and joints with adjacent floor tile joints.
8. Heights:
   a. As indicated on Drawings.

C. Base Tile Trim Units - With wall tile above:
1. Edge trim and other details to be as indicated on Drawings.

2.3 SETTING MATERIALS

A. Bond Coat Materials: As recommended by tile manufacturer and TCNA for substrate types and installation conditions.
1. Latex/Polymer Modified Portland Cement Mortar:
   a. Complying with ANSI A118.4.
2. Modified Dry-Set Mortar for Large and Heavy Tile (LHT) Mortar:
   a. Application: Bond coat for large tiles with at least one side measuring 15 inches or greater.
   b. Complying with ANSI A118.4H.
   c. Approved by manufacturer for application thickness 3/32 inch to 1/2 inch.
   d. Manufacturers:
      1) Laticrete International, Inc. - LHT Plus.
      2) Mapei Corporation - Ultraflex LHT.
      3) H.B. Fuller Corporation, Inc. - TEC PermaFlex 300 LHT Mortar.

2.4 GROUT AND JOINT MATERIALS

A. Manufacturers:
1. Ardex Engineered Cements: www.ardexamericas.com/#sle.
2. Custom Building Products: www.custombuildingproducts.com/#sle.
3. Laticrete International, Inc.: www.laticrete.com/#sle.
4. MAPEI Corporation: www.mapei.com.
5. Merkrete, by Parex USA, Inc.: www.merkrete.com/#sle.

B. High Performance Cement Grout: ANSI A118.7, polymer modified cement grout.
1. Applications:
   a. Use this type of grout where indicated and where no other type of grout is indicated.
2. Use sanded grout for joints 1/8 inch wide and larger; if joint design is indicated to be less than 1/8 inch wide, use unsanded grout.
3. Color(s): To be selected by Architect from full range of colors
4. Basis of Design: Laticrete PermaColor Grout.

C. Tile Joint Sealant: Gunable, silicone, siliconized acrylic, or urethane sealant; moisture and mildew resistant type.
1. Applications: Control joints; tile surface change of plane; tile abutment joints to dissimilar materials such as, but not limited to, door frames, drains, gypsum wall board, concrete masonry units, and plumbing pipe penetrations.
2. Color: Match grout color.
3. Use sanded type for joints designed to be 1/8 inch or wider.
4. Use unsanded type for joints designed to be less than 1/8 inch.
5. Products: Same manufacturer as grout material or as per written recommendation from grout manufacturer.

D. Grout Joint Sealer: Liquid-applied, moisture and stain protection for existing or new Portland cement grout.

1. Composition: Water-based colorless silicone.
2. Products: Same manufacturer as grout material or as per written recommendation from grout manufacturer.

2.5 TILE BACKER BOARD MATERIAL

A. Cement Backer Board: Non-gypsum-based; aggregated portland cement backer board with glass fiber mesh embedded in front and back surfaces complying with ANSI A118.9 or ASTM C1325 (Type A or B, depending on application as follows).
   1. Application:
      a. ASTM C1325 (Type B): Interior applications and exterior soffit applications.
   2. Coordination: Coordinate material and installation with compatibility and requirements for tiling systems and manufacturer's recommendations.
   3. Combustibility: Noncombustible complying with ASTM E136.
   4. Surface Burning Characteristics: When tested in accordance with ASTM E84.
      a. Flame Spread: Zero.
      b. Smoke Development: Zero.
      c. Class: Class A.
   5. Mold Resistance:
      a. Score of 10, when tested in accordance with ASTM D3273.
   6. Compressive Strength: 1,250 psi minimum, when tested in accordance with ASTM D2394.
   7. Thickness:
      a. Interior Use: 5/8 inch.
   8. Spacing of support framing members to be as recommended by board manufacturer, but no greater than 16 inches OC.
   9. Screws for Fastening Board Materials to Steel Framing Members:
      a. Non-corrosive type and in compliance with ANSI 108.11.
   10. Joint Tape and Finish Compound: Comply with ANSI 108.11 and as recommended by backer board manufacturer for compatibility with subsequent applied materials.
      a. Do not use paper tape or gypsum joint compound.
   11. Manufacturer:
      a. USG - Durock Cement Board with EdgeGuard. (Basis of Design)
   12. Locations: Framed construction indicated to receive tile finish.
      a. Wet Areas: Includes tile areas at tubs, showers, floor sinks and where otherwise indicated on Drawings.

2.6 ACCESSORY MATERIALS

A. Waterproofing Membrane: Provide membrane system designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10 (waterproofing).
   1. Fluid or Trowel Applied Type:
      a. Membrane Material: Synthetic rubber.
      b. Thickness:
         1) 40 mils (1.00 mm), minimum, dry film thickness.
      c. Products:
         1) Custom Building Products: RedGard Crack Prevention and Waterproofing Membrane: www.custombuildingproducts.com
         2) Laticrete International, Inc.: Laticrete Hydro Ban: www.laticrete.com
         3) Merkrete, by Parex USA, Inc.: Merkrete Hydro Guard 2000: www.merkrete.com
         4) TEC, an H.B. Fuller Construction Products Brand; TEC HydraFlex Waterproofing Crack Isolation Membrane: www.tecspecialty.com

2. Crack Isolation Reinforcing Fabric: Fabric type as recommended by waterproofing membrane manufacturer.
3. When both a Crack Isolation Membrane and a Waterproofing Membrane are indicated, both membranes are to be manufactured by same manufacturer and designed to be compatible with each other, the substrate, and the subsequent applied materials.

B. Crack Isolation Membrane: Provide membrane system designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.12 (crack isolation).
1. Fluid or Trowel Applied Type:
   a. Membrane Material: Synthetic rubber.
   b. Thickness:
      1) 40 mils (1.00 mm), minimum, dry film thickness.
   c. Products:
      1) Custom Building Products: RedGard Crack Prevention and Waterproofing Membrane: www.custombuildingproducts.com
      2) Laticrete International, Inc.: Laticrete Hydro Ban: www.laticrete.com
      3) Merkrete, by Parex USA, Inc.: Merkrete Hydro Guard 2000: www.merkrete.com
      4) TEC, an H.B. Fuller Construction Products Brand; TEC HydraFlex Waterproofing Crack Isolation Membrane: www.tecspecialty.com
2. Crack Isolation Reinforcing Fabric: Fabric type as recommended by crack isolation membrane manufacturer.
3. When both a Crack Isolation Membrane and a Waterproofing Membrane are indicated, both membranes are to be manufactured by same manufacturer and designed to be compatible with each other, the substrate, and the subsequent applied materials.

C. Cleavage Membrane: ANSI A108.02.
1. Polyethylene Sheeting: 4 mil (0.1 mm) thickness; complying with ASTM C171 or ASTM D4397.
   a. Application: Under mortar bed of thick mortar bed tile installation method.

D. Reinforcing Metal Fabric: ANSI A108.02.
1. Welded Wire Fabric: 2 x 2 inches (51 by 51 mm) size weave of 16/16 wire size; welded fabric; galvanized steel; complying with ASTM A1064/A1064M.
   a. Application: Suspended in mortar bed of thick mortar bed tile installation method.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 73 00 - Execution: Verification of existing conditions before starting work.

B. Verify that substrates to be tiled are sound, smooth, and flat within the tolerances specified for that type of work and are ready to receive tiling.

C. Verify that cracks in substrates to be tiled can be repaired, to include compatible crack isolation membrane, as required to prevent defects from occurring in the tiling work and finish. Remove and replace defective substrate materials.

D. Verify that sufficient solid anchorage materials are installed for anchoring other work elements that are to be secured through tile.

E. Verify that substrates to be tiled are dust-free and free of substances that could impair bonding of membrane and setting materials to substrate surfaces.

F. Verify that substrate slopes to drains where floor drains are indicated in contract documents.

G. For mortar bed method of tile installation, verify that sub-floor is recessed deep enough to accommodate mortar bed thickness variations to achieve slope to floor drains.

H. Verify the locations of areas that are to receive specified waterproofing membrane prior to proceeding with thin-set method and mortar bed method of tile installations.

I. Verify that concrete and CMU substrates are ready for tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within limits recommended by manufacturers of tile system components.

J. Verify that required floor-and wall mounted utilities and devices are at correct location, alignment, and elevation.

K. Verify that floor drains are aligned as indicated on Drawings. If alignment is not indicated on Drawings, aligned parallel with tile pattern joint lines.

3.2 PREPARATION

A. Section 01 73 00 - Execution: Prepare field conditions and existing construction for installation of work of this Section.

B. Prepare materials to be installed and equipment to be used during installation.

C. Protect surrounding work from damage.

D. Vacuum clean surfaces and damp clean.

E. Seal substrate surface cracks with filler compatible with tiling system components. Level existing substrate surfaces to acceptable flatness tolerances.

F. Prepare substrate surfaces for installation of waterproofing and crack isolation membrane in accordance with membrane manufacturer's instructions.

G. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

3.3 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

3.4 INSTALLATION - GENERAL

A. Install tile, transition and termination trim, accessories, setting materials, grout, joint sealants, and all tile work components in accordance with applicable requirements of ANSI A108/A118/A136, product manufacturer's instructions, TCNA (HB) recommendations, and the Drawings.

B. Lay tile to pattern indicated. 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, base, and wall joints.

D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size.

E. Wall Corners: Form internal angles square and external angles bullnosed.

F. Install non-ceramic trim in accordance with manufacturer's instructions.

G. Install thresholds where indicated on Drawings and at floor tile open edges.

H. Sound test tiles after setting. Replace hollow sounding tiles that are not fully bonded to substrate.

I. Construct expansion, movement, control, contraction, perimeter, and soft joints in compliance with the applicable TCNA (HB) Methods prescribed for joint construction type indicated.
   1. Keep such joints free of mortar, grout, adhesive and debris that can interfere with application of final joint construction components.

J. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

K. Prior to grouting, prepare and protect the finish surfaces of tile work as needed to prevent staining of tile work during the grouting process and cleanup. Tile work that is stained by grout or other material is not acceptable tile work.

L. Grout tile joints unless otherwise indicated. Grout joints to be without voids, cracks, excess mortar or excess grout, or too little grout.

M. Tile Sealant Application: Use tile joint sealant instead of grout at the following locations.
   1. Tile changes in plane and tile-to-tile control joints. Use either bond breaker tape or backer rod as appropriate to prevent sealant from bonding to tiled substrate.
   2. Tile abutment joints to dissimilar materials such as door frames, drains, GWB, CMU, and penetrations such as plumbing piping and countertop support brackets.

N. Apply grout sealer in accordance with grout and tile manufacturers' instructions.

3.5 INSTALLATION - TILE BACKER BOARD

A. Install panels and finish joints and fastener locations according to ANSI A108.11 and backer board manufacturer's written instructions for type of application indicated.

3.6 INSTALLATION - CRACK ISOLATION MEMBRANE

A. Install components to comply with ANSI A108.17 (crack isolation), and manufacturer's written instructions.

B. Existing Cracks: Comply with TCNA Method F125-Partial; bridging existing cracks and include use of crack isolation reinforcing fabric.

C. Full Substrate Coverage: Comply with TCNA Method F125-Full; full substrate coverage.
   1. Include bridging existing cracks; TCNA Method F125-Partial.
   2. Membrane to be uniform thickness and bonded securely to substrate.
   3. Allow membrane to cure before installing tile or setting materials.

3.7 INSTALLATION - WATERPROOFING MEMBRANE

A. Install components to comply with ANSI A108.13 (waterproofing), and manufacturer's written instructions.

B. Existing Cracks: Comply with TCNA Method F125-Partial for bridging existing cracks and include use of crack isolation reinforcing fabric.

C. Full Substrate Coverage:
   1. Include bridging existing cracks; TCNA Method F125-Partial.

2. Membrane to be waterproof, uniform thickness and bonded securely to substrate.
3. Allow membrane to cure and verify waterproof condition by testing before installing tile or setting materials.

D. Transition of waterproofing membrane from floor tile to wall:
1. Extend continuous floor membrane up behind wall base tile.
2. Extend continuous floor membrane up behind wall tile.
   a. Where Drawings indicate wall tile to be "without" waterproofing membrane, extend membrane up behind wall tile 4 inches from floor.

E. Transition of waterproofing membrane from shower area to floor tile beyond where floor tile beyond is indicated to be "without" waterproofing membrane:
1. Extend continuous floor membrane beyond shower curtain line minimum 36 inches in front of shower and 24 inches left and right of shower opening, and up behind wall base tile contiguous to the extended membrane areas. Feather membrane edges at perimeters of extended membrane areas.

3.8 INSTALLATION - INTERIOR FLOORS: THIN-SET METHOD

A. To be used at locations where concrete substrate IS NOT DEPRESSED.

B. TCNA Method F122: On-ground concrete.
1. Locations: Wet areas and as indicated here; otherwise use TCNA Method F113.
   a. Showers (all tiling surfaces).
   b. Wash Basins (all tiling surfaces).
   c. Group Toilet Rooms (floor tiling and wall base tiling only).
   d. Single Occupancy Toilet Rooms (floor tiling and wall base tiling only).
   e. Locker and Dressing Rooms (floor tiling and wall base tiling only).
   f. Dishwashing Areas (floor tiling and wall base tiling only).
   g. Food Preparation Areas (floor tiling and wall base tiling only).
   h. Mechanical Rooms (floor tiling and wall base tiling only).
   i. Areas with similar surfaces subject to periods of running or standing water.
   j. Other areas indicated on Drawings to receive waterproofing membrane.
2. Waterproofing Membrane; ANSI A118.10.
3. Crack Isolation Membrane; ANSI A118.12.
   a. TCNA Method F125-Partial with crack isolation reinforcing fabric.
4. Bonding Coat:
   a. Latex/Polymer Modified Portland Cement Mortar; ANSI A118.4.
   b. Modified Dry-Set Mortar for Large and Heavy Tile (LHT) Mortar; ANSI A118.4H.
5. Grout:
   a. High Performance Cement Grout; ANSI A118.7.

C. TCNA Method F122A: Above-ground concrete.
1. Locations: Wet areas and as indicated here; otherwise use TCNA Method F113A.
   a. Showers (all tiling surfaces).
   b. Wash Basins (all tiling surfaces).
   c. Group Toilet Rooms (floor tiling and wall base tiling only).
   d. Single Occupancy Toilet Rooms (floor tiling and wall base tiling only).
   e. Locker and Dressing Rooms (floor tiling and wall base tiling only).
   f. Dishwashing Areas (floor tiling and wall base tiling only).
   g. Food Preparation Areas (floor tiling and wall base tiling only).
   h. Mechanical Rooms (floor tiling and wall base tiling only).
   i. Areas with similar surfaces subject to periods of running or standing water.
   j. Other areas indicated on Drawings to receive waterproofing membrane.
2. Waterproofing Membrane; ANSI A118.10.

3. Crack Isolation Membrane; ANSI A118.12.
   a. TCNA Method F125-Partial with crack isolation reinforcing fabric.
4. Bonding Coat:
   a. Latex/Polymer Modified Portland Cement Mortar; ANSI A118.4.
   b. Modified Dry-Set Mortar for Large and Heavy Tile (LHT) Mortar; ANSI A118.4H.
5. Grout:
   a. High Performance Cement Grout; ANSI A118.7.

D. TCNA Method F113: On-ground concrete.
1. Locations:
   a. Locations that ARE NOT indicated to receive waterproofing membrane in this Section or on Drawings.
   b. Locations that ARE NOT indicated to be installed with other TCNA Method.
2. Crack Isolation Membrane; ANSI A118.12.
   a. TCNA Method F125-Partial: At all existing cracks.
3. Bonding Coat:
   a. Latex/Polymer Modified Portland Cement Mortar; ANSI A118.4.
   b. Modified Dry-Set Mortar for Large and Heavy Tile (LHT) Mortar; ANSI A118.4H.
4. Grout:
   a. High Performance Cement Grout; ANSI A118.7.

3.9 INSTALLATION - WALLS: THIN-SET METHODS

A. TCNA Method W202E.
1. Locations:
   a. Exterior and interior locations on masonry and concrete substrates.
   b. Waterproofing membrane required in wet areas, and for exterior applications, or if otherwise indicated on Drawings.
2. Waterproofing Membrane; ANSI A118.10 (waterproofing), specified in this Section.
3. Bonding Coat:
   a. Latex/Polymer Modified Portland Cement Mortar:
      1) Complying with ANSI A118.4.
   b. Modified Dry-Set Mortar for Large and Heavy Tile (LHT) Mortar; ANSI A118.4H.
4. Grout:
   a. High Performance Cement Grout: ANSI A118.7.

3.10 ADJUSTING

A. Section 01 73 00 - Execution: Starting, testing, adjusting, and balancing.

B. Remove and replace unacceptable tiles. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement. Unacceptable tiles include, but are not limited to, the following:
1. Tile that is damaged.
2. Tile that does not match adjoining tile or is not compliant with the color/pattern indicated.
3. Tile that is not fully bonded to substrate.

3.11 CLEANING

A. Section 01 73 00 - Execution and Section 01 77 00 - Closeout Procedures: Related to cleaning.

B. Clean all ceramic tile surfaces so they are free of foreign matter.

C. Remove grout residue and stains from tile as soon as possible.

D. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions and use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.12 PROTECTION

A. Section 01 73 00 - Execution: Protecting installed construction.

B. Protect installed tile work with kraft paper or other heavy covering during construction period.

C. Prohibit foot and wheel traffic from tiled floors for at least seven (7) days after grouting is completed.

D. Remove protective coverings and clean for substantial completion inspection and for final inspection. Between inspections, reinstall protective coverings and maintain protection of work.

END OF SECTION

Construction Documents 6/12/24

SECTION 09 51 13

ACOUSTICAL PANEL CEILINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Acoustic Ceiling Panels.
   2. Suspension Grid Systems.

B. Related Requirements:
   1. Section 04 20 00 - Unit Masonry.
   2. Section 07 95 13 - Expansion Joint Cover Assemblies.
   3. Section 09 21 16 - Gypsum Board Assemblies.
   4. Division 21 - Fire Suppression: Coordinate with devices in areas of work.
   5. Division 23 - HVAC: Coordinate with devices in areas of work.
   6. Division 26 - Electrical: Coordinate with devices in areas of work.
   7. Division 27 - Communications: Coordinate with devices in areas of work.
   8. Division 28 - Electronic Safety and Security: Coordinate with devices in areas of work.

1.2 REFERENCES

A. American Society of Civil Engineers (ASCE):
   1. 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 International (ASTM):
   1. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy- Coated (Galvannealed) by the Hot-Dip Process; 2023.
   2. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.
   3. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2022.
   4. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2019.
   5. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
   6. 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; 2022.
   7. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2023.

1.3 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

B. Coordinate other construction that is concealed by or interfaces with the work of this Section. This includes, but is not limited to, wall devices, light fixtures, HVAC equipment, and fire suppression system components.

1.4 SEQUENCING

A. Section 01 30 00 - Administrative Requirements: Scheduling and sequencing.

B. Sequence work as to not install work until building is enclosed, sufficient air temperature and humidity level is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

C. Install ceiling panels after interior wet work is dry.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data on suspension grid system components, acoustic panels, and accessories.

C. Shop Drawings: Show suspension grid layout and dimensioning, panel layouts, lighting fixtures, air diffusers, grilles, and all other items exposed in acoustical ceilings, locations of seismic braces and hangers, and suspension, seismic and bracing details. Show details of junctions with other work or ceiling finishes, and special conditions.

D. Provide seismic design of suspended ceiling systems under direct supervision and sealed by Professional Structural Engineer.
   1. Provide sealed calculations indicating that design of suspension systems provide compliance with seismic structural requirements indicated in the Performance and Design Requirements article in this Section.

E. Samples:
   1. Submit two samples 12 x 12 inches in size illustrating material, fabrication, and finish of acoustic panels.
   2. Submit two samples each, 6 inches long, of suspension system main runner, cross runner, perimeter wall molding and trim, and seismic components.

F. Designer's Qualification Statement.

G. Manufacturer's Qualification Statement.

H. Installer's Qualification Statement.

I. Manufacturer’s Installation Instructions: Submit special procedures, and perimeter conditions requiring special attention.

1.6 QUALIFICATIONS

A. Designer Qualifications for Seismic Design: Perform 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. Acoustical Panels and Suspension System Manufacturer Qualifications: Company specializing in manufacturing products indicated with minimum five (5) years documented experience.

C. Installer: Company specializing in performing indicated work with minimum five (5) years documented experience.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Maintain the following minimum environmental requirements in installation areas prior to, during, and after acoustic panel installation. If manufacturer's requirements are more stringent, comply with manufacture's requirements.
   1. Enclosed and weatherproof; wet work in place is completed and nominally dry; free of construction dust and debris.
   2. Ambient air conditions of temperature and humidity are continuously maintained at values intended for final occupancy and operations.

1.8 SPARE PARTS AND MAINTENANCE PRODUCTS

A. Section 01 60 00 - Product Requirements: Extra materials, spare parts, and maintenance products.
   1. Furnish 200 sq ft of extra panels of each type and size of acoustical panel to Owner.

PART 2 PRODUCTS

2.1 PERFORMANCE AND DESIGN REQUIREMENTS:

A. Seismic Loads: Design and size components to withstand seismic loads and sway displacement as calculated according to ASCE 7 and applicable codes.
   1. Design is to include compliance with ASTM E580/E580M.
   2. Seismic Design is to comply with requirements for the Seismic Design Category as indicated on the Structural Drawings and Section 00 31 00 - Available Project Information.

B. Surface Burning Characteristics: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

C. Suspension System: Secure acoustic ceiling system including integral mechanical and electrical components with maximum deflection of 1/360.

2.2 ACOUSTIC PANEL CEILING SYSTEMS

A. Manufacturers:
   1. Armstrong World Industries.
   2. CertainTeed.
   3. USG Interiors.
   4. Rockfon
   5. Substitutions: Section 01 60 00 - Product Requirements.

2.3 ACOUSTIC PANELS

A. Acoustic Panels - **Type APC1**:
   1. Basis of Design:
      a. Armstrong - Calla (2824).
   2. Classification: ASTM E1264, Type IV - Mineral fiber with acoustically transparent membrane and factory-applied latex paint.
      a. Form: 2 - water felted.
      b. Pattern:
         1) Smooth
      c. Fire Class A, ASTM E84.
      d. Sag Resistant.
      e. Mold and Mildew Resistant.
   3. Size: 24 x 24 inches.
   4. Thickness:

a. 1 inch.
5. Light Reflectance: 85 percent.
6. NRC: 0.85.
7. CAC: 35.
8. Edge: Formed to suit grid profile.
   a. Tegular Square (Calla 2824).
9. Surface Color:
   a. White.
10. Suspension Grid Type as indicated in this Section:
    a. Suspension Grid Type SG-1.

B. Acoustic Panels - **Type APC-2**:
1. Basis of Design: Armstrong - Optima Health Zone (3214PB).
2. Classification: ASTM E1264, Type XII - Glass fiber with acoustically transparent membrane and factory-applied latex paint.
   a. Form: 2.
   b. Pattern:
      1) Fine
   c. Fire Class A, ASTM 84.
   d. Sag Resistant.
   e. Mold and Mildew Resistant.
3. Size: 24 x 24 inches.
4. Thickness:
   a. 1 inch.
5. Light Reflectance: 86 percent.
6. NRC: 0.95.
7. CAC: N/A
8. Edge: Formed to suit grid profile.
   a. Tegular Square.
9. Surface Color: White.
10. Suspension Grid Type as indicated in this Section:
    a. Suspension Grid Type SG-1.

C. Acoustic Panels - **Type APC-3**
1. Basis of Design:
   a. Armstrong – School Zone (1820).
2. Classification: ASTM E1264, Type IV - Mineral fiber with acoustically transparent membrane and factory-applied latex paint.
   a. Form: 2 - water felted.
   b. Pattern:
      1) Fine Fissuer
   c. Fire Class A, ASTM E84.
   d. Sag Resistant.
   e. Mold and Mildew Resistant.
3. Size: 24 x 24 inches.
4. Thickness:
   a. 3/4 inch.
5. Light Reflectance: 82 percent.
6. NRC: 0.70.
7. CAC: 35.
8. Edge: Formed to suit grid profile.
   a. Tegular Square.
9. Surface Color:
   a. White.

10. Suspension Grid Type as indicated in this Section:
    a. Suspension Grid Type SG-1.

2.4 SUSPENSION GRID SYSTEMS

A. General:
1. Support Channels and Hangers: Primed steel; size and type to suit application, seismic requirements, load support requirements, and ceiling system flatness requirements.
2. Provide stabilizer bars, clips, splices, and perimeter wall moldings and trim required for suspension grid system, and as indicated on Drawings and in this Section.

B. Suspension Grid - **Type SG-1**: Exposed to view.
1. Basis of Design: Manufacturer to be same as manufacturer of ceiling panels.
    a. Armstrong - Prelude XL.
2. Non-fire Rated Grid: ASTM C635/C635M, exposed T; components die cut and interlocking.
    a. Structural Classification:
        1) Intermediate-duty.
3. Grid Materials: Hot-dipped galvanized steel sheet complying with ASTM A653/A653M.
4. Exposed Grid Surface Width:
    a. 15/16 inch.
5. Grid Finish Color:
    a. White.
6. Perimeter Wall Moldings and Trim: As indicated in ACCESSORIES article.

2.5 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

B. Perimeter Wall Moldings: Perimeter wall moldings for termination and support of suspension grid system at abutment to vertical construction and other grid system interruptions:
1. Material, Finish Type and Color: Match suspension grid system.
2. For Exposed Suspension Grid System:
    a. L-shaped molding; 7/8 inch exposed face; mounted flush with grid face.
3. For Concealed Suspension Grid System:
    a. Concealed molding.
4. Manufactured Corners: Provide single piece seamless corners conforming to corner angle or radius.
5. Manufactured Radius: Provide seamless radius trim at maximum lengths practical but not less than 8 feet.
6. Manufactured Column Rings : Provide bend radius to match column size and radius that intersects ceiling condition.
7. Manufactured Transition molding: Provide step transition modeling at acoustical panels ceiling condition to gypsum wall board.
    a. Condition as indicated in the drawings.
    b. BOD: Armstrong – Transitions Moldings, F-Molding Transition, 9/16”, 120”, 9/16” vertical flange.

C. Exposed fastener heads to be shop finished to match grid system finish type and color.

D. Touch-up Paint: Type and color to match acoustic panels and grid components.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 73 00 - Execution: Examination, coordination, and project conditions.

B. Verify layout of hangers will not interfere with other work.

3.2 PREPARATION

A. Section 01 73 00 - Execution: Prepare field conditions and existing construction for installation of work of this Section.

B. Prepare materials to be installed and equipment to be used during installation.

3.3 INSTALLATION

A. Section 01 73 00 - Execution: Related to installation of Work.

B. Suspension Grid 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. Suspended ceilings are subject to special inspection.
3. Locate system on room axis according to reflected ceiling plan in Drawings.
4. Install after major above ceiling work is complete. Coordinate location of hangers with other work. Coordinate with sprinkler head penetrations for oversized trim if not braced. Ceilings without rigid bracing must have 2 inch oversized trim rings for sprinklers and other penetrations.
5. Install suspension system in accordance with manufacturer’s seismic requirements and installation guide, and in compliance with the Seismic Design Category design requirements.
6. Ceiling areas over 1,000 SF must have horizontal restraint wire or rigid bracing.
7. Ceiling areas over 2,500 SF must have seismic separation joints or full height partitions.
8. Install system capable of supporting imposed loads to deflection of 1/360 maximum.
9. Ends of cross tees to be locked into main beams to prevent their spreading.
10. Hang suspension system from building structural members and independent of walls, columns, ducts, pipes, cable trays, and conduit. Do not hang suspension system from non-structural building elements. Do not hang suspension system from roof deck. Do not allow suspension system components to touch ducts, pipes, conduit, or other ceiling installations.
11. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
12. Changes in ceiling plane must have positive bracing.
13. Where ducts or other equipment prevent regular spacing of hangers, reinforce nearest affected hangers, and related carrying channels to span extra distance.
14. Do not support components on main runners or cross runners when weight causes total dead load to exceed deflection capability. Support fixture loads by supplementary hangers located within 6 inches of each corner; or support components independently.
15. Do not eccentrically load system or produce rotation of runners.
16. Perimeter Wall Moldings:
    a. Install perimeter wall molding at ceiling abutment to vertical construction.
    b. Use longest practical lengths.
    c. Install manufactured seamless corners.
    d. Install manufactured seamless radius trim at curved walls and round columns.

e. Overlap and rivet corners.

17. Perimeter Face Trim:
    a. Install perimeter face trim at floating edge (exposed edge) termination of ceiling and suspension grid system if such conditions are indicated on Drawings.
    b. Use longest practical lengths.
    c. For straight perimeter face trim corners, provide factory formed, single piece units with finished corner legs that receive and join the two perimeter trim ends.
    d. Provide concealed diagonal trim face bracing when trim vertical face is 8 inches or greater. This is to reinforce trim face at vertical alignment.
18. Form expansion joints as detailed. Form to accommodate plus or minus 1 inch movement. Maintain visual closure.

C. Acoustic Panels:
1. Fit acoustic panels in place, free from damaged edges or other defects detrimental to appearance and function.
2. Lay directional patterned panels as shown on the Drawings. Fit border trim neatly against abutting surfaces.
3. Install panels after above ceiling work is complete.
4. Install acoustic panels level, in uniform plane, and free from twist, warp, and dents.
5. Cutting Acoustic Panels:
    a. Cut to fit irregular grid and perimeter edge trim.
    b. Make field cut edges of same profile as factory edges.
    c. Double cut and field finish exposed edges to match panel finish.
6. Where round obstructions and bullnose concrete block corners occur, provide preformed closures to match perimeter wall molding or trim.
7. Install hold-down clips on each panel to retain panels tight to grid system; comply with fire rating requirements.
8. Install hold-down clips to retain panels tight to suspension grid system within 10 feet of exterior door.
9. Install acoustical insulation as indicated on Drawings.

3.4 ERECTION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

C. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.5 CLEANING

A. Section 01 73 00 - Execution and Section 01 77 00 - Closeout Procedures: Clean installed work and comply with manufacturer's recommendations.

B. Clean installed work in accordance with manufacturer's recommended materials and procedures.

3.6 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 73 00 - Execution: Protecting installed construction.

B. Protect against modifications to completed suspension and hanger systems by unauthorized persons.

C. Protect installed work from damage and marring of finishes. Remove and replace components that become damaged.

3.7 SCHEDULES

A. Refer to Reflected Ceiling Plans, Finish Schedules, Details, and Notes on Drawings for locations and configurations of systems indicated in this Section.

END OF SECTION

SECTION 09 64 66
WOOD ATHLETIC FLOORING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Wood flooring for athletic and sports areas.

B. Related Requirements:
   1. Section 03 30 00 - Cast-In-Place Concrete: Substrate for flooring system.

1.2 REFERENCES

A. APA - The Engineered Wood Association (APA).

B. ASTM International (ASTM):
   1. ASTM D2240 - Standard Test Method for Rubber Property-Durometer Hardness; 2015, Reapproval 2021.
   2. ASTM D3676 - Standard Specification for Rubber Cellular Cushion Used for Carpet or Rug Underlay; 2018.
   3. ASTM D4397 - Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Application; 2016.
   4. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2019a, Editorial Changes 2020.
   5. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.
   6. ASTM F1861 - Standard Specification for Resilient Wall Base; 2021.
   7. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2022.
   8. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.

C. American Wood Protection Association (AWPA).
   1. AWPA U1 - Use Category System: User Specification for Treated Wood; 2023.

D. California Department of Public Health (CDPH):
   1. CDPH Standard Method VOC v1.2 - Standard Method For The Testing And Evaluation Of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers - Version 1.2; 2017.

E. Maple Flooring Manufacturers Association, Inc. (MFMA):
   1. MFMA Standards:
      a. Guide Specifications for Maple Flooring Systems; Current Edition Online, www.maplefloor.org/ForArchitects/Specifying-a-Floor.aspx.
      b. PUR - Performance and Uniformity Rating Sport Specific Standards; Current Edition Online, www.maplefloor.org/Standards/PUR-Standards.aspx.
      c. Athletic Flooring Sealer and Finish Specifications and Conformance List; Current Edition Online, www.maplefloor.org/TechnicalInfo/Finishes-Sealers.aspx.

F. National Federation of State High School Associations (NFHS):
   1. NFHS - Court and Field Diagram Guide; Current Edition Online, www.nfhs.com.

1.3 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

B. Coordinate the installation of the concrete substrate with the requirements of the Work of this Section.
   1. The finish elevation of the depressed concrete is to be equal to the assembled and finished flooring system as required to achieve flush flooring transitions. The concrete finish is to be steel troweled to a true level and finished smooth and straight to a tolerance of 1/4 inch in a 10 foot radius. High spots are to be ground level and low spots filled in with approved leveling compounds to achieve the required elevation and level flatness.

C. Floor Boxes, Access Covers, Trim and Other Floor Devices: Coordinate work of this Section with work requirements by others that interface with the work of this Section.

1.4 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this Section. Review the work requirements, application procedures, quality control, testing and inspection and production schedule.

C. Using a small mockup assembly (about 12 inches square) of the flooring systems, demonstrate that the assembled flooring systems will finish level and flush with adjacent floor finishes at doorways, openings, and points of egress.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Provide data for materials and accessories; include standard construction details, material descriptions, dimensions of individual components, profiles, assemblies, and finishes.

C. Shop Drawings: Indicate floor joint pattern and termination details.
   1. Indicate materials, layout, dimensions, installation details, moisture protection, methods of attachment in construction, relationships, and transitions to surrounding and adjacent construction, base and trim details, direction of wood strips and floor boxes and devices.
   2. Indicate provisions for expansion and contraction, base, base corner details.
   3. Indicate equipment inserts, floor boxes, sockets, and other devices within the flooring area.
   4. Indicate location, size, design, and color of game line markings and graphics.

D. Samples - Wood Flooring Samples:
   1. Samples for Initial Selection: Submit two paper chip samples; 2 x 3 inches in size; illustrating range of stained and non-stained colors and sheens available for each wood species indicated; submit for Architect’s initial selections.
   2. Samples for Verification: From the Architect’s initial selections, prepare and submit two samples for each selected color and sheen; minimum 8 x 8 inches assembled of actual wood strips of each wood species required in construction. Where finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.

E. Manufacturer's Certifications:
   1. Certify products meet or exceed specified requirements.
   2. Certify compatibility of complete finishing systems.

3. Certify approval of Installer.

F. Installation Instructions: Indicate standard and special installation procedures. Include instructions for applying finishing system.

G. Maintenance Data: Include maintenance procedures and recommended maintenance materials.

1.6 CLOSEOUT SUBMITTALS

A. Section 01 77 00 - Closeout Procedures.

B. Operation and Maintenance Data: Submit manufacturer's instructions for maintaining and refinishing of each flooring type installed.

1.7 QUALITY ASSURANCE

A. Perform work of this Section in accordance with MFMA Standards.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this Section with minimum six (6) years documented experience.
1. Certification: Provide flooring that carries MFMA mark on each bundle or piece.
2. Member mill of the Maple Flooring Manufacturers Association, Inc (MFMA).

C. Installer Qualifications: Company specializing in performing work of the type specified and with at least six (6) years of documented experience.
1. Single Source Responsibility: Engage a single qualified Installer to provide the work of this Section.
2. Approved by flooring manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Do not deliver wood components and other materials until after concrete, masonry, ceramic tile, terrazzo, and similar wet work is complete, cured, and dry.

C. Moisture Content: At time of delivery to Project, maintain 6 to 9 percent average moisture content.

D. Accept materials on site in manufacturer's original packaging. Inspect for damage.

E. Store wood components and other materials in a dry, warm, well-ventilated, weathertight location, in a horizontal position, and protected from exposure to moisture.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Requirements before, during and after Work.

B. Do not install wood flooring until wet construction work is complete and permanent heat and air conditioning is installed and operating.

C. Maintain room temperature between 65 degrees F and 75 degrees F and relative humidity between 35 to 40 percent for a period of seven (7) days prior to delivery of materials to installation area, during installation, and after installation.

D. Acclimate flooring materials by storing materials in conditioned installation area prior to installation as follows:
1. 7 days, minimum.

1.10 WARRANTY

A. Section 01 77 00 - Closeout Procedures: Product warranties.

B. Manufacturer's Warranty: Furnish two (2) year warranty against defects in materials and workmanship.

C. Installer's Warranty: Furnish three (3) year warranty for materials, installation, and finish.

1.11 SPARE PARTS AND MAINTENANCE PRODUCTS

A. Section 01 60 00 - Product Requirements: Extra materials, spare parts, and maintenance products.
   1. Extra Flooring Material: Provide ten (10) square yards of each flooring type installed; unfinished; full size units; unassembled.

PART 2 PRODUCTS

2.1 WOOD ATHLETIC FLOORING

A. Description: Floating system; tongue and grove wood strips; over plywood subfloor; over wood sleepers with resilient pads; over vapor retarder; on concrete slab-on-grade.
   1. Finishing: Refer to WOOD FLOOR FINISH MATERIALS articles in this Section.

B. Manufacturers:
   1. Aacer Flooring, LLC.
   2. Action Floor Systems.
   3. Connor.
   4. Horner Flooring Company.
   5. Robbins, Inc.
   6. Substitutions: Section 01 60 00 - Product Requirements.

C. Basis of Design:
   1. Connor - DuraCushion III.

D. Components:
   1. Wood Strip Flooring: Comply with MFMA Standards.
      a. Species: Northern Hard Maple.
      b. Grade:
         1) Second and better grade.
      c. Cut: Edge grain.
      d. Moisture Content: 6 to 9 percent.
      e. Actual Thickness: 25/32 inch.
      f. Actual Width: 2-1/4 inches.
      g. Edge: Tongue and groove cut.
      h. End: End matched.
      i. Back Channeling: Back channel each piece according to manufacturer's standards, unless specifically recommended by manufacturer and installer to be plain or flat backed for application indicated.
      j. Length: Random, 8 feet, minimum of 9 inches.
      k. Seasoning: Kiln dry flooring before milling. Air dried flooring will not be acceptable.
   2. Wood Subflooring: Plywood; APA Rated Sheathing, span rating of 40/20; C-D Exposure 1; square edges; preservative-treated.
      a. Edges: Square cut.

b. Thickness: Number of layers and thickness to be as indicated on Drawings, but initial layer on sleepers to be not less than 5/8 inch thick.

3. Sleepers and Shims: Standard grade, nominal 2 by 3 inches by 4 feet long, kiln dried Eastern hemlock, fir, pine, or spruce, waterborne pressure preservative-treated according to AWPA U1, Use Category UC2.
4. Resilient Cushion Pads: Resilient pads, rubber material, unsealed air slots for resiliency; 2-1/4 x 3 inches size and 3/8 inch thick; factory applied to bottom of sleepers at 12 inches o.c. and each end.
5. Vapor Retarder: ASTM D4397, black polyethylene sheet, 8 mil thick; 2 inch wide tape as recommended by vapor retarder manufacturer for continuous joint sealing.

2.2 ACCESSORIES

A. Flooring System Fasteners: Non-corrosive type as recommended by flooring system manufacturer.

B. Subflooring Fasteners: Screws of non-corrosive type; length as required to secure each subflooring layer into sleepers below.

C. Perimeter Springs: Flat spring steel, leaf shaped, with attachment clips, 0.093 x 1 x 9 inches size.

D. Transition Covers: Extruded aluminum, ADA compliant, top grooved parallel to length, factory countersunk anchor holes, and mill finished.

E. Vented Wall Base: Molded rubber complying with ASTM F1861, Type TS, Group 1 (solid) Standard Specification for Resilient Wall Base.

1. Pre-molded outside corners with minimum 3 inch returns. Pre-molded end caps.
2. Size: 4 inches (10.16 cm) high by 5/16 inch (7.94 mm) thick coved profile with a 3 inch (7.62 cm) long by 3/8 inch (9.53 mm) thick toe.
3. Venting: Back of vertical surface grooved with vertical semi-circular vents. 15 vents per 4 ft. length.
4. Length: Minimum 4 foot lengths.
5. Hardness: ASTM D2240 - Not less than 85 Shore A.
6. Fire Resistance: Meets ASTM E648 - Class I.
7. Comply with ASTM F1861 requirements for resistance to heat/light aging, chemicals, and dimensional stability.
8. Color: To be as selected by Architect from manufacturer's full range.

2.3 GAME LINES AND GRAPHICS

A. Apply painted lines and graphics after wood sealer coating and before wood finish coating.

B. Game Lines: Layout to be as indicated on Drawings and in compliance with the current NFHS - Court and Field Diagram Guide.

C. Graphics:

1. Provide twelve (12) graphic letters at each end of main gym basketball court; 20 inches high; uppercase; one color and font to be selected by Architect from full range.
2. Provide 14 ft diameter custom graphic logo at center of main gym basketball court. Graphic design to be provided by Architect. Three (3) colors to be selected by Architect from full range.

2.4 WOOD FLOOR FINISH MATERIALS

A. Provide certification that wood floor finish materials are compatible with each other and the wood flooring material.

B. Wood Fillers and Penetrating Stain: Fillers to be tented and stained to match final color of wood. Stain color as selected by Architect from manufacturer's full range.

C. Game Lines and Graphics Paint: High gloss acrylic paint to be provided by or recommended by wood sealer and finish system manufacturer.
   1. Apply after wood sealer coating and prior to wood finish coating.

D. Wood Sealer and Finish System: Comply with MFMA Standards and the current MFMA Conformance List.
   1. Manufacturer:
      a. BonaKemi USA, Inc.
      b. Hillyard Industries, Inc.
      c. Poloplaz by Canlak Coatings Company.
   2. Oil-Based System:
      a. Oil-Based Sealer: Two coats; MFMA Approved - Group 1.
         1) Basis of Design:
            a) Hillyard - Gold Medalist Wood Seal (2 coats).
      b. Oil-Based Finish: Two coats; MFMA Approved - Group 3.
         1) Basis of Design:
            a) Hillyard - Gold Medalist Gym Finish (1 coat), and 450 Gym Finish (1 coat).

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 73 00 - Execution: Verification of existing conditions before starting work.

B. Verify compliance with the requirements in the PART 1, ENVIRONMENTAL REQUIREMENTS article.

C. Verify that existing conditions are as required before starting work of the Section.

D. Verify that the finish elevation of the depressed concrete is equal to the assembled and finished flooring system as required to achieve flush flooring transitions.

E. Verify that the assembled and finished floor system of this Section will finish flush with floor boxes, inserts, devices, and adjacent finished floors. This flush transition requirement cannot be over emphasized. The transition joints must be tight and flush to eliminate trip hazards.

F. Verify that floor boxes, inserts, utilities, and other floor devices are installed in correct locations.

G. Verify that all adjacent work (including flooring by others) is completed and that overhead work trades have finished their work in the flooring areas.

H. Verify that the building is dry, all openings are closed in, adequate ventilation is provided, and permanent heating and air conditioning is installed operating and providing the required conditioning of the air in the work area.

I. Verify that surfaces are 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.

J. Verify that the concrete finish has been steel troweled to a true level and finished smooth and straight to a tolerance of 1/4 inch in a 10 foot radius. High spots are to be ground level

and low spots filled in with approved leveling compounds to achieve the required elevation and level flatness.

K. 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 wall base material.

L. Verify that the concrete substrate is dry in accordance with industry standard testing procedures, free of foreign materials, and broom cleaned.

M. Cementitious Substrate Surfaces Testing: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).
1. Alkalinity (pH) Testing: ASTM F710. Measurement for pH range is to be not less than 7 pH and not more than 9 pH, unless written recommendations of flooring manufacturer or adhesive manufacturer are more stringent.
2. Internal Relative Humidity Testing: ASTM F2170. Perform test using in situ probes. Humidity level of substrates is to measure no more than 75 percent relative humidity level, unless written recommendations of flooring manufacturer or adhesive manufacturer are more stringent.
3. Moisture Vapor Emission Testing: ASTM F1869. Perform anhydrous calcium chloride test. Moisture vapor emission rate (MVER) from the slab is to be less than or equal to 3 lbs of water per 1,000 sf in 24 hours, unless written recommendations of flooring manufacturer or adhesive manufacturer are more stringent.
4. Conduct tests by an independent testing agency acceptable to Owner.

N. Do not proceed with installation work until noncompliant conditions have been corrected.

3.2 PREPARATION

A. Section 01 73 00 - Execution: Prepare field conditions and existing construction for installation of work of this Section.

B. Prepare materials to be installed and equipment to be used during installation.

C. Comply with product manufacturer's site and material condition requirements for installation.

D. Clean substrate.

3.3 INSTALLATION

A. Section 01 73 00 - Execution: Related to installation of Work.

B. Comply with MFMA Standards and the requirements in this Section.

C. Floor Boxes, Access Covers, and Other Floor Devices: Coordinate work of this Section with other contractors/installers of such devices and trim components.

D. Install floor sockets and inserts to a depth sufficient to ensure flush top surface with floor surface.

E. Cushioned Sleepers:
1. Place vapor retarder over concrete subfloor surface, lapping edges and ends minimum 6 inches and tape for continuous seal; spot glue in place.
2. Place cushioned sleepers over vapor retarder; end to end at right angles to the direction of the finish wood flooring strips. Stagger end joints 24 inches minimum. Space sleepers 12 inches on center. Do not secure to concrete subfloor. Maintain an expansion void at walls and all vertical obstructions; void size as recommended by manufacturer, but no less that 1-1/2 inches.

a. Coordinate with requirements of fixed or telescoping bleachers to provide additional sleepers or blocking as support of bleachers bearing on or tracking across wood strip flooring system.

3. Install shims as required for equal bearing on concrete substrate and to achieve level line of plus or minus 1/8 inch in a 10 feet radius.

F. Wood Subflooring: Place plywood subflooring over sleepers.

1. Lay plywood with the long edge perpendicular to the sleepers, with end joints over sleepers, and secure to sleepers with fasteners at 12 inches on center or closer if recommended by manufacturer.
2. If two layers of subflooring are indicated, continue as follows:
   a. Place sheathing paper between subflooring layers, lapping edges and ends 2 inches, staple in place.
   b. Lay the second layer in the same direction as first layer, with edge joints offset from first layer by 24 inches and end joints offset from first layer by one sleeper. Secure to sleepers with fasteners at 12 inches on center.

G. Prepare wood subfloor to receive wood flooring in accordance with manufacturer's recommendations and MFMA Standards.

H. Broom clean wood subfloor.

I. Sheathing Paper: Place between top of wood subfloor and bottom of finish wood flooring; lap edges and ends 2 inches, staple in place.

J. Wood Strip Flooring:

1. Install in accordance with manufacturer's recommendations and MFMA Standards; predrill and blind nail to sleepers.
2. Wood Strip Direction - Unless indicated otherwise on Drawings, lay wood flooring strips parallel to the main playing court. Verify alignment as work progresses.
3. Arrange flooring with end matched grain set flush and tight.
4. Terminate flooring at adjacent flooring, allowing expansion void, and install aluminum saddle type threshold of such width and thickness as to bridge the expansion void.
5. Where divider strips and transition strips are required, provide such strips in accordance with flooring manufacturer's recommendations and as indicated.
6. Install edge strips at unprotected or exposed edges, and where flooring terminates.
7. Secure edge strips before installation of flooring with stainless steel screws.
8. Install flooring tight to floor access covers, unless indicated otherwise by manufacturer’s installation recommendations.
9. Install flooring under movable partitions without interrupting floor pattern.
10. Provide expansion requirements in field and space at fixed walls and other interruptions as needed for expansion and contraction.
11. At cushioned sleepers, install springs in perimeter expansion space at 24 inches.

K. Finishing Wood Strip Flooring:

1. Allow installed flooring to acclimate to ambient conditions for a minimum period of 7 days before sanding.
2. Mask off and protect adjacent surfaces before beginning sanding.
3. Sand flooring to smooth even finish with no evidence of sander marks. Take precautions to contain dust.
   a. Machine sand with coarse, medium, and fine grades of sandpaper. After sanding, buff entire floor using 120 grit screen or equal grit sandpaper, with a heavy-duty buffing machine.

b. Clean with power vacuum, tack, and check to confirm that entire surface of each piece has been sanded, and that floor is level and smooth, without ridges or cups. Proceed immediately with finish process.

4. Apply finish system in accordance with floor finish manufacturer's recommendations and MFMA Standards.
   a. Where penetrating stain is indicated, apply prior to first coat of sealer.
   b. Where painted game lines or other graphics are indicated, apply after second coat of sealer.
      1) Lay out lines, fields and other graphics as indicated for colored enamel application. Mask flooring to provide sharp edges.
      2) Apply game lines and graphics with crisp and distinct edges.
      3) Apply game lines straight and true.
      4) Main basketball court lines are continuous. Main volleyball court lines are secondary and will break at main basketball court lines.
      5) Apply paint to minimum 1.0 mil thickness, in colors as indicated, or as selected by Architect.
5. Allow each coat to cure. Buff lightly to remove irregularities. Vacuum clean and wipe with damp cloth and allow to dry before applying succeeding coat.
6. Apply last coat of finish. After the last coat of finish has cured, if there are any areas of the finish that appear to have a dull or inconsistent sheen, apply additional finish coats as required to achieve a consistent and uniform sheen.

L. Install wall base at floor perimeter to cover expansion space in accordance with manufacturer's instructions. Miter inside corners and install premolded outside corners.

3.4 CLEANING

A. Section 01 73 00 - Execution and Section 01 77 00 - Closeout Procedures: Clean installed work and comply with manufacturer’s recommendations.

B. Clean and polish floor surfaces in accordance with flooring and finishing manufacturers’ recommended material, procedures, and instructions.

3.5 PROTECTION

A. Section 01 73 00 - Execution: Protecting installed construction.

B. Prohibit traffic on floor finish for 48 hours after installation.

C. Place protective coverings over finished floors; do not remove coverings until Substantial Completion inspection by Architect. Resume protection until final completion.

END OF SECTION

Construction Documents 6/12/24

SECTION 09 65 00
RESILIENT FLOORING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Resilient tile flooring.
2. Resilient wall base - non-vented type.
3. Resilient stair covering.

B. Related Requirements:
1. Section 03 30 00 - Cast-In-Place Concrete: Finishing of floor slab for resilient floor application.
2. Sections indicating Plumbing, Electrical and Mechanical as related to floor installed devices such as drains, utility boxes, devices, and trim.

1.2 REFERENCES

A. ASTM International (ASTM):
1. ASTM D2240 - Standard Test Method for Rubber Property-Durometer Hardness; 2015, Reapproval 2021.
2. ASTM D3389 - Standard Test Method for Coated Fabrics Abrasion Resistance (Rotary Platform Abrader); 2021.
3. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023c.
4. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2019a, Editorial Revisions 2020.
5. ASTM E662 - Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials; 2021a, Editorial Revisions.
6. ASTM F150 - Standard Test Method for Electrical Resistance of Conductive and Static Dissipative Resilient Flooring; 2006, Reapproval 2018.
7. ASTM F386 - Standard Test Method for Thickness of Resilient Flooring Materials Having Flat Surfaces; 2017, Reapproval 2022.
8. ASTM F410 - Standard Test Method for Wear Layer Thickness of Resilient Floor Coverings by Optical Measurement; 2008, Reapproval 2022.
9. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.
10. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile; 2004, Reapproval 2018.
11. ASTM F1344 - Standard Specification for Rubber Floor Tile; 2021a.
12. ASTM F1700 - Standard Specification for Solid Vinyl Floor Tile; 2020.
13. ASTM F1861 - Standard Specification for Resilient Wall Base; 2021.
14. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2023.
15. ASTM F1913 - Standard Specification for Vinyl Sheet Floor Covering Without Backing; 2019.
16. ASTM F1914 - Standard Test Methods for Short-Term Indentation and Residual Indentation of Resilient Floor Covering; 2018.
17. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.

18. ASTM F2195 - Standard Specification for Linoleum Floor Tile; 2018, Reapproval 2023.
19. ASTM F2421 - Standard Test Method for Measurement of Resilient Floor Plank by Dial Gauge; 2019a.

B. National Fire Protection Association (NFPA):
1. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2023.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data describing physical and performance characteristics; include manufacturer's full range of sizes, patterns, colors, and finishes available; include moldings, transition and edge trim as indicated on Drawings and otherwise recommended by manufacturer of Resilient Floor products; include installation instructions.

C. Shop Drawings: Submit shop drawings indicating each product, locations, layouts, dimensions, patterns, trim details, and interface with adjacent work by others.

D. Samples for Initial Selection: Two manufacturer's complete set of color samples illustrating the full range of sizes, patterns, colors, and finishes available; submit for Architect's initial selections.

E. Samples for Verification: From the Architect's initial selections, prepare and submit two samples for each selection; samples to be same product material type indicated for final Work; each sample 4 x 4 inches. Where finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 78 23 - Operation and Maintenance Data.

B. Operation and Maintenance Data: Submit maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.6 MOCK-UPS

A. Section 01 40 00 - Quality Requirements: Mock-up requirements.

B. At project site, install mock-up using acceptable products and manufacturer approved installation methods, including concrete substrate testing. Obtain Architect's approval of mock-up.
1. Mock-up Size and Locations: One typical room; location as indicated by Architect.
2. Mock-up may be incorporated into the final construction upon Architect's approval for mock-up to remain.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.

C. Store all materials off the floor in an acclimatized, weather-tight space.

D. Maintain temperature in storage area between 55 degrees F and 90 degrees F.

E. Protect roll materials from damage by storing on end.

F. Do not double stack pallets.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Requirements before, during and after Work.

B. Store materials for not less than 48 hours prior to installation in area of installation at temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

1.9 WARRANTY

A. Section 01 77 00 - Closeout Procedures: Product warranties.

B. Vinyl Composition Tile: Provide five (5) year manufacturer's warranty.

C. Luxury Vinyl Tile:
1. Flooring Tiles of Class III, Type B - Embossed Surface with minimum of 0.020 inch (20 mil) Wear Layer: Provide fifteen (15) year manufacturer's warranty.

1.10 SPARE PARTS AND MAINTENANCE PRODUCTS

A. Section 01 60 00 - Product Requirements: Extra materials, spare parts, and maintenance products.
1. Resilient Flooring:
   a. Luxury Vinyl Tile (LVT) Flooring: 100 sq ft of each type and color.
   b. All Other Resilient Flooring: 50 sq ft of each type and color.
2. Resilient Wall Base: 100 lineal feet of each type and color.
3. Resilient Stair Covering Materials: 5 percent of installed materials of each type and color.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire Performance Characteristics: Unless otherwise indicated, provide resilient flooring products with the following fire performance characteristics in accordance with the standards. Testing to be by a certified testing laboratory or other testing agency acceptable to authorities having jurisdiction:
1. Surface Burning Characteristics: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.
2. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter (Class 1) in accordance with ASTM E648 or NFPA 253.
3. Smoke Density: 450 or less in accordance with ASTM E662.

2.2 RESILIENT TILE FLOORING

A. Luxury Vinyl Tile (LVT):
1. LVT-1

a. Basis of Design: Tarkett – Event Abstract – Peme Melange – 11188 Pietro - 18" x 18" x 2.5mm
b. Alternate 1 - Mohawk Group - Living Local Collection – Chromascope C0159 – Alabaster 120 – 12” x 24” x 2.5mm
c. Alternate 2 - Interface - Scorpio - Silverlight A01716 - 50cm x 50cm x 4.5 mm
d. Alternate 3 – Patcraft – CMYK 1426V – Smoke-V2 00530 – 12” x 24” x 2.5mm

2. LVT-2
   a. Basis of Design: Tarkett – Event Abstract – Peme Melange – 11189 Onyx - 18" x 18" x 2.5mm
   b. Alternate 1 – Mohawk Group – Living Local Collection – Chromascope C0159 – Dire Wolf 960 – 12” x 24” x 2.5mm
   c. Alternate 2 - Interface - Scorpio - Pewter A01717 - 50cm x 50cm x 4.5mm
   d. Alternate 3 – Patcraft – CMYK 1426V – Obsidian-V2 00590 – 12” x 24” x 2.5mm
3. LVT-2A
   a. Basis of Design: Tarkett – Event Abstract – Peme Melange – 11189 Onyx - 18" x 18" x 4.5mm
   b. Alternate 1 – Mohawk Group – Living Local Collection – Chromascope C0159 – Dire Wolf 960 – 12” x 24” x 4.5mm
   c. Alternate 2 - Interface - Scorpio - Pewter A01717 - 50cm x 50cm x 4.5mm
   d. Alternate 3 – Patcraft – CMYK 1426V – Obsidian-V2 00590 – 12” x 24” x 4.5mm
4. LVT-3
   a. Basis of Design: Tarkett – Event Abstract – Peme Melange – 11183 Daisy - 18" x 18" x 2.5mm
   b. Alternate 1- Mohawk Group – Living Local Collection – Chromascope C0159 – Yellow Bird 360 – 12” x 24” x 2.5mm
   c. Alternate 2 - Interface - Scorpio - Yellow A01701 - 50cm x 50cm x 4.5mm
   d. Alternate 3 – Patcraft – CMYK 1426V – Sungold-V2 00230 – 12”x24”x2.5mm
5. LVT-4
   a. Basis of Design: Tarkett - ID Latitude Wood - Laurel Oak PLWD 3523 LW - 6" x 48"x 2.5mm
   b. Alternate 1 - Mohawk Group – Living Local Collection – Premium Wood C0194 – Almond 330 – 7.72” x 51.97” x 2.5mm
   c. Alternate 2 - Interface - Level Set Natural Woodgrains - Beech A00204 - 25cm x 1m x 4.5mm
   d. Alternate 3 – Patcraft – True Species I733V – Light Rustic-V3 00740 – 18cm x 120cm x 2.5mm

2.3 RESILIENT WALL BASE - NON-VENTED TYPE

A. Manufacturers:
1. Mannington Commercial.
2. Johnsonite, a Tarkett Company.
3. Roppe Corporation.
4. Flexco
5. Substitutions: Section 01 60 00 - Product Requirements.

B. Basis of Design:
1. Flexco

C. Resilient Non-vented Wall Base:
1. Comply with ASTM F1861.
a. Type:
1) Type TS - Rubber, vulcanized thermoset.
b. Group:
1) Group 1 - Solid.
c. Style:
1) Style B - Top set, Cove.
2) Style A - Top set, Straight.
2. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter (Class 1), when tested in accordance with ASTM E648 or NFPA 253.
3. Smoke Density: 450 or less in accordance with ASTM E662.
4. Height:
a. 4 inches.
5. Thickness: 0.125 inch thick.
6. Finish: Satin.
7. Length: Roll.
8. Accessories: Premolded external corners and end stops.
9. Colors: Solid.
a. As indicated on Drawings.

2.4 RESILIENT WALL BASE - VENTED TYPE

A. Manufacturers:
1. Johnsonite, a Tarkett Company (Basis of Design).
2. Mannington Commercial.
3. Roppe Corp.
4. Felxco
5. Substitutions: Section 01 60 00 - Product Requirements.

B. Basis of Design:
1. Felxco

C. Resilient Vented Cove Wall Base:
1. Comply with ASTM F1861.
a. Type:
1) Type TS - Rubber, vulcanized thermoset.
b. Group:
1) Group 1 - Solid.
c. Style - Coved with semi-circular vents on back of vertical leg.
2. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter (Class 1), when tested in accordance with ASTM E648 or NFPA 253.
3. Smoke Density: 450 or less in accordance with ASTM E662.
4. Height:
a. 4 inches.
5. Thickness: 5/16 inch thick coved profile with a 3/8 inch thick toe.
6. Finish: Satin.
7. Length: 8 feet.
8. Accessories: Premolded external corners and end stops.
9. Colors: Solid.
a. As indicated on Drawings.

2.5 RESILIENT STAIR COVERING

A. Manufacturers:
1. Flexco Corporation.
2. Interface, Inc.
3. Johnsonite, a Tarkett Company.
4. Mannington Commercial.
5. Substitutions: Section 01 60 00 - Product Requirements.

B. Basis of Design:
1. Flexco Corporation.

C. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter (Class 1) in accordance with ASTM E648 or NFPA 253.

D. Smoke Density: 450 or less in accordance with ASTM E662.

E. Material:
1. Rubber.

F. Covering Style:
1. Nosing/Tread Style: Single piece covering full width and depth of stair nosing and tread; nosing not less than 1-3/4 inches deep.

G. Nosing:
1. Thickness: Minimum 0.210 inch.
2. Angle and profile to match profile of riser below for full adhesion without gaps that could cause trip hazard.
3. Integral non-slip abrasive nose strip; contrasting color complying with visually impaired requirements.
   a. Width to be 2 inches.
4. Integral photoluminescent (glow-in-the-dark) nose strip; 2 inches wide (1 inch along nose vertical face and 1 inch along nose top); contrasting color complying with visually impaired requirements.

H. Tread Design Pattern:
1. Round discs; raised.

I. Stair Landings Flooring: Same manufacturer, material, color, and pattern as the Stair Covering.

J. Colors: Integral throughout product.
1. To be selected by Architect from manufacturer's full range.

2.6 ACCESSORIES

A. Subfloor Filler: Factory mixed latex type recommended by manufacturers of flooring and adhesive materials and compatible with substrate materials and conditions.

B. Primers and Adhesives: Waterproof type recommended by manufacturer of flooring material and compatible with substrate materials and conditions.

C. Moldings, Transition and Edge Strips: As indicated on Drawings or as otherwise selected by Architect from Product Data submittals.

D. Feature Strips: Of same material as tile. Width as indicated on Drawings.

E. Cleaner, Sealer and Wax/Polish: Provide finishing products, equipment, and application as recommended by flooring material manufacturer.
1. Cleaner: As required for cleaning.
2. Sealer: 2 coats minimum.

3. Wax/Polish: 4 coats minimum.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 73 00 - Execution: Verification of existing conditions before starting work.

B. Verify compliance with the requirements in the PART 1, ENVIRONMENTAL REQUIREMENTS article.

C. Verify that existing conditions are as required before starting work of the Section.

D. Verify that the assembled and finished floor system of this Section will finish flush with floor boxes, inserts, devices, and adjacent finished floors. This flush transition requirement cannot be over emphasized. The transition joints must be tight and flush to eliminate trip hazards.

E. Verify that floor boxes, inserts, utilities, and other floor devices are installed in correct locations.

F. Verify that overhead work trades have finished their work in the flooring areas.

G. Verify that the building is dry, all openings are closed in, adequate ventilation is provided, and permanent heating and air conditioning is installed operating and providing the required conditioning of the air in the work area.

H. Verify that surfaces are 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.

I. Verify that the concrete finish has been steel troweled to a true level and finished smooth and straight to a tolerance of 1/4 inch in a 10 foot radius. High spots are to be ground level and low spots filled in with approved leveling compounds to achieve the required elevation and level flatness.
   1. Sloped Concrete: Levelness is relative to slopes indicated such as slopes to drains.

J. 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 wall base material.

K. Verify that the concrete substrate is dry in accordance with industry standard testing procedures, free of foreign materials, and broom cleaned.

L. Cementitious Substrate Surfaces Testing: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).
   1. Alkalinity (pH) Testing: ASTM F710. Measurement for pH range is to be not less than 7 pH and not more than 9 pH, unless written recommendations of flooring manufacturer or adhesive manufacturer are more stringent.
   2. Internal Relative Humidity Testing: ASTM F2170. Perform test using in situ probes. Humidity level of substrates is to measure no more than 75 percent relative humidity level, unless written recommendations of flooring manufacturer or adhesive manufacturer are more stringent.
   3. Moisture Vapor Emission Testing: ASTM F1869. Perform anhydrous calcium chloride test. Moisture Vapor Emission Rate (MVER) from the slab is to be less than or equal to 3 lbs of water per 1,000 sf in 24 hours, unless written recommendations of flooring manufacturer or adhesive manufacturer are more stringent.

4. Conduct tests by an independent testing agency acceptable to Owner.

M. Do not proceed with installation work until noncompliant conditions have been corrected.

3.2 PREPARATION

A. Section 01 73 00 - Execution: Prepare field conditions and existing construction for installation of work of this Section.

B. Prepare materials to be installed and equipment to be used during installation.

C. Prepare substrates to receive work as recommended by work product manufacturers.

D. Remove sub-floor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.

E. Prohibit traffic until filler is cured.

F. Clean substrate.

G. Apply primer as recommended by resilient flooring product manufacturer and where required to prevent "bleed-through" or interference with adhesion.

3.3 INSTALLATION

A. Section 01 73 00 - Execution: Related to installation of Work.

B. General:
1. Starting installation constitutes acceptance of sub-floor conditions.
2. Install in accordance with manufacturer's written instructions and recommendations to ensure warranty requirements.
3. Spread only enough adhesive to permit installation of materials before initial set.
4. Fit joints and butt seams tightly.
5. Set flooring in place, press with heavy roller to attain full adhesion. Sound top surface of installed flooring material to ensure there are no hollow sounds (hollow sound may indicate flooring that is not fully adhered/bonded to substrate).
6. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door (door in closed position).
7. Install edge transition strips at unprotected or exposed edges, where flooring terminates, where flooring transitions to dissimilar flooring finishes and as indicated on Drawings.
8. Resilient Strips: Attach to substrate using adhesive.
9. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.
10. Install flooring in recessed floor access covers, maintaining floor pattern.
11. At movable partitions, install flooring under partitions without interrupting floor pattern.
12. If feature strips/designs are indicated on Drawings, install feature strips/designs.
13. Non-Factory Finished Flooring: Provide flooring finishes as indicated and in accordance with flooring manufacturer's recommendations.

C. Resilient Tile Flooring:
1. Mix tile from containers to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.
2. Unless flooring layout design is indicated otherwise on Drawings, lay flooring with joints and seams parallel to building lines to produce symmetrical tile pattern.

3. Install tile to pattern indicated on Drawings. Allow minimum 1/2 full size tile width at room or area perimeter.

D. Resilient Wall Base:
1. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.
2. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.
3. Install wall base on solid backing. Bond tightly to wall and floor surfaces. Bottom edge of wall base should be consistently in contact with finished flooring.
4. Scribe and fit to door frames and other interruptions.

E. Resilient Stair Coverings:
1. Install stair coverings in one piece for full width of stairs.
2. Install stringers configured tightly to stair profile.
3. Adhere over entire surface. Fit accurately and securely.
4. Nosing angle and profile is to match the profile of the riser below. Install nosing with full adhesion ensuring that bottom edge of the nosing is without gaps and does not create a protruding tripping hazard.

3.4 CLEANING

A. Section 01 73 00 - Execution and Section 01 77 00 - Closeout Procedures: Related to cleaning.

B. Remove excess adhesive from installed work and adjacent surfaces without damage to surfaces.

C. Clean and maintain the work.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 73 00 - Execution: Protecting installed construction.

B. Prohibit traffic on flooring for duration recommended by manufacturer and not less than the following:
1. Light Foot Traffic: 24 hours after installation.
2. Rolling Load Traffic: 72 hours after installation.

C. Protect the work from stains and damage.

END OF SECTION

Construction Documents 6/12/24

SECTION 09 65 66

RESILIENT ATHLETIC FLOORING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Flooring Type:
      a. Vinyl sheet flooring, fully adhered.
      b. Rubber sheet flooring, fully adhered.
   2. Game lines and graphics.
   3. Wall base.

B. Related Requirements:
   1. Section 03 30 00 - Cast-in-Place Concrete: Coordinate compatibility of concrete curing compounds with finish flooring application requirements.
   2. Section 09 65 00 - Resilient Flooring: Wall base finish.
   3. Division 12 - Furnishings: Loads imposed on flooring by furnishings.

1.2 REFERENCES

A. ASTM International (ASTM):
   1. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 2022.
   2. ASTM D2047 - Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine; 2017.
   3. ASTM D2240 - Standard Test Method for Rubber Property-Durometer Hardness; 2015, Reapproval 2021.
   4. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source, 2019, Editorial Changes 2020.
   5. ASTM E662 - Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials; 2021.
   6. ASTM F137 - Standard Test Method for Flexibility of Resilient Flooring Materials with Cylindrical Mandrel Apparatus; 2008, Reapproval 2018.
   7. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.
   8. ASTM F925 - Standard Test Method for Resistance to Chemicals of Resilient Flooring; 2013, Reapproval 2020.
   9. ASTM F970 - Standard Test Method for Measuring Recovery Properties of Floor Coverings after Static Loading; 2022.
   10. ASTM F1303 - Standard Specification for Sheet Vinyl Floor Covering with Backing; 2004, Reapproval 2021.
   11. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2022.
   12. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.
   13. ASTM F2199 - Standard Test Method for Determining Dimensional Stability and Curling Properties of Resilient Flooring after Exposure to Heat; 2020.

B. National Fire Protection Association (NFPA):
   1. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2023.

1.3 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

B. Cast-in-Place Concrete: Coordinate compatibility of concrete curing compounds with finish flooring application requirements.

C. Telescoping Bleachers: Coordinate installation of flooring with loads imposed by telescoping bleachers (if any) to provide adequate support for bleacher rollers and to not exceed resilient athletic flooring load rating (psi).

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Manufacturer's printed data sheets for products specified.

C. Shop Drawings:
1. Fabrication and installation details.
2. Layout, colors, and widths of game lines and graphics.
3. Equipment locations including floor inserts for athletic equipment installed through flooring.

D. Samples for Initial Selection: Two manufacturer's complete sets of color samples illustrating the full range of finishes and colors available; submit for Architect’s initial selections.
1. Include color charts for game line and graphics paints.

E. Samples for Verification: From the Architect’s initial selections, prepare and submit two samples for each selected finish and color; samples to be same product material type indicated for final Work; each sample 12 x 12 inches mounted on solid backing. Where finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.
1. Include samples of game lines, illustrating colors selected.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer certified in writing by the flooring manufacturer to be qualified for installation of specified flooring system.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.

C. Store all materials off the floor in an acclimatized, weather-tight space.

D. Maintain temperature in storage area between 55 degrees F and 90 degrees F.

E. Protect roll materials from damage by storing on end.

F. Do not double stack pallets.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Requirements before, during and after Work.

B. Store materials for not less than 48 hours prior to installation in area of installation at temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

1.8 WARRANTY

A. Section 01 77 00 - Closeout Procedures: Product warranties.

B. Provide ten (10) year manufacturer's warranty in which manufacturer agrees to repair or replace sports flooring, including labor, that fails within specified warranty period.

C. Provide two (2) year installer's warranty in which installer agrees to repair or replace sports flooring that fails due to poor workmanship or faulty installation within the specified warranty period.

1.9 SPARE PARTS AND MAINTENANCE PRODUCTS

A. Section 01 60 00 - Product Requirements: Extra materials, spare parts, and maintenance products.
   1. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
      a. Sheet Flooring: Furnish full-width rolls of not less than 10 linear feet for each 500 linear feet or fraction thereof, of each type, color, and pattern of flooring installed.

PART 2 PRODUCTS

2.1 PREFORMED ATHLETIC FLOORING

A. Vinyl Sheet Flooring:
   1. Wearing Surface: Pure polyvinyl chloride, mechanically extruded and uniformly resilient material with uniform color throughout thickness. Comply with ASTM F1303.
   2. Backing: PVC foam. Comply with ASTM F1303.
   3. Sheet Total Thickness:
      a. Minimum 0.26 inch (6.6 mm).
   4. Sheet Wear Layer Thickness: Minimum 0.040 inch (1.0 mm).
   5. Sheet Width: Minimum 59 inches (1500 mm).
   6. Sheet Lengths: Minimum 49 feet (15 m).
   7. Ball Rebound: Minimum 96 percent.
   8. Seaming Method: Welding with heat or chemical.
   9. Surface Texture: Embossed.
   10. Colors and Patterns:
      a. As selected by Architect from manufacturer's full range.
   11. Game Lines and Graphics: High gloss coating as approved by sheet flooring manufacturer.
      a. Game Lines:
         1) Layout shall be as indicated on Drawings and in compliance with the current NFHS - Court and Field Diagram Guide.
         2) Provide 14 feet diameter custom graphic logo at center of main gym basketball court; three colors. Graphic design to be provided by Architect.
   12. Top Coat: If recommended by sheet flooring manufacturer to protect game lines, graphics and wearing surface, apply clear top coat material as recommended by flooring manufacturer.
   13. Manufacturers: All products by the same manufacturer.
      a. Gerflor.
      b. Shaw Contract.
      c. Tarkett Sports.

d. Substitutions: See Section 01 60 00 - Product Requirements.

14. Basis of Design:
    a. Gerflor, unless indicated otherwise on Drawings.

B. Rubber Sheet Flooring:
1. Density: 80 lb/cubic foot (ASTM D3676).
2. Hardness: 60 plus or minus 5 (ASTM D2240 (Shore A)).
3. Tear Strength: 70 lb/linear inch, minimum (ASTMD624).
4. Elongation: 300 percent, minimum (ASTM D412).
5. Tensile Strength: 200 lb/sq inch, minimum (ASTM D412).
6. Flexibility: 1/4 inch, Mandrel Pass (ASTM F137).
7. Resistance to Chemicals: No change (ASTM F925).
8. Coefficient of Friction: 0.95, minimum (ASTM D2047).
9. Width: 48 inches wide rolls.
10. Thickness:
    a. 9 mm.
11. Colors and Patterns: As selected by Architect from manufacturer's full range.
12. Manufacturers: All products by the same manufacturer.
    a. Tarkett Sports.
    b. Connor.
    c. Mondo America.
    d. Allstate Flooring
    e. Substitutions: See Section 01 60 00 - Product Requirements.
13. Basis of Design:
    a. Allstate Flooring – ReNew Rubber Flooring

C. Wall Base:
1. Provide as indicated in Section 09 65 00 - Resilient Flooring and on Drawings.
2. Colors:
    a. As selected by Architect from manufacturer's full range as submitted under Section 09 65 00.

2.2 ACCESSORIES

A. Leveling Compound: Type recommended by flooring manufacturer for substrate conditions and bond for flooring adhesive.

B. Flooring Adhesive: Waterproof type recommended by flooring manufacturer for the flooring material and substrate conditions.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 73 00 - Execution: Verification of existing conditions before starting work.

B. Verify compliance with the requirements in the PART 1, ENVIRONMENTAL REQUIREMENTS article.

C. Verify that existing conditions are as required before starting work of the Section.

D. Verify that the assembled and finished floor system of this Section will finish flush with floor boxes, inserts, devices, and adjacent finished floors. This flush transition requirement cannot be over emphasized. The transition joints must be tight and flush to eliminate trip hazards.

E. Verify that floor boxes, inserts, utilities, and other floor devices are installed in correct locations.

F. Verify that overhead work trades have finished their work in the flooring areas.

G. Verify that the building is dry, all openings are closed in, adequate ventilation is provided, and permanent heating and air conditioning is installed operating and providing the required conditioning of the air in the work area.

H. Verify that surfaces are 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.

I. Verify that the concrete finish has been steel troweled to a true level and finished smooth and straight to a tolerance of 1/4 inch in a 10 foot radius. High spots are to be ground level and low spots filled in with approved leveling compounds to achieve the required elevation and level flatness.
   1. Sloped Concrete: Levelness is relative to slopes indicated such as slopes to drains.

J. 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 wall base material.

K. Verify that the concrete substrate is dry in accordance with industry standard testing procedures, free of foreign materials, and broom cleaned.

L. Cementitious Substrate Surfaces Testing: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).
   1. Alkalinity (pH) Testing: ASTM F710. Measurement for pH range is to be not less than 7 pH and not more than 9 pH, unless written recommendations of flooring manufacturer or adhesive manufacturer are more stringent.
   2. Internal Relative Humidity Testing: ASTM F2170. Perform test using in situ probes. Humidity level of substrates is to measure no more than 75 percent relative humidity level, unless written recommendations of flooring manufacturer or adhesive manufacturer are more stringent.
   3. Moisture Vapor Emission Testing: ASTM F1869. Perform anhydrous calcium chloride test. Moisture vapor emission rate (MVER) from the slab is to be less than or equal to 3 lbs of water per 1,000 sf in 24 hours, unless written recommendations of flooring manufacturer or adhesive manufacturer are more stringent.
   4. Conduct tests by an independent testing agency acceptable to Owner.

M. Do not proceed with installation work until noncompliant conditions have been corrected.

3.2 PREPARATION

A. Section 01 73 00 - Execution: Prepare field conditions and existing construction for installation of work of this Section.

B. Prepare materials to be installed and equipment to be used during installation.

C. Prepare substrates to receive work as recommended by work product manufacturers.

D. Remove sub-floor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.

E. Prohibit traffic until filler is cured.

F. Clean substrate.

G. Apply primer as recommended by resilient flooring product manufacturer and where required to prevent "bleed-through" or interference with adhesion.

3.3 INSTALLATION

A. Section 01 73 00 - Execution: Related to installation of Work.

B. Starting installation constitutes acceptance of sub-floor conditions.

C. Vinyl Sheet Flooring:
1. Comply with manufacturer's installation instructions and recommendations and approved shop drawings.
2. Unroll flooring and allow to relax before beginning installation.
3. Mix adhesive thoroughly and apply to substrate with notched trowel. Roll flooring into fresh adhesive, overlapping end seams and double cutting, butting factory edges and compression fitting.
4. Roll entire flooring surface with steel roller to assure adhesion to substrate and eliminate air bubbles.
5. Immediately remove any adhesive from flooring surface, using chemical recommended by flooring manufacturer.
6. Weld seams using techniques and equipment recommended by manufacturer.
7. Lay out game lines using tape and taping machine approved by flooring manufacturer. Apply game line paint with roller and allow to dry before removing tape.
8. Apply transparent top coat over flooring if recommended by manufacturer for protection and to achieve a uniform finished appearance.

D. Rubber Sheet Flooring:
1. Comply with Drawings, and manufacturer's installation instructions, and recommendations.

E. Games Lines and Graphics: Refer to PART 2 PRODUCTS in this Section for sheet flooring material description and subparagraphs therein.

F. Install wall base.

3.4 CLEANING

A. Section 01 73 00 - Execution and Section 01 77 00 - Closeout Procedures: Related to cleaning.

B. Clean flooring using methods recommended by manufacturer.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 73 00 - Execution: Protecting installed construction.

B. Protect finished flooring from construction traffic and maintain without damage.

END OF SECTION

SECTION 09 67 23
RESINOUS FLOORING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Seamless resinous flooring systems with integral cove base.

B. Related Requirements:
   1. Section 03 30 00 - Cast-In-Place Concrete: Concrete subfloor.

1.2 REFERENCES

A. ASTM International (ASTM):
   1. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.
   2. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2023.
   3. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.

B. International Concrete Repair Institute (ICRI):
   1. ICRI 310.2R - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair; 2013.

1.3 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

B. Coordinate finishing of the concrete substrate with the requirements for the flooring system to be installed.

C. Coordinate curing materials to be used during concrete substrate installation with requirements for flooring system materials. The intent is to prevent installation of curing materials that may inhibit the flooring system's bond/adhesion to concrete substrate.

D. Coordinate slopes to floor drains during concrete substrate installation.

1.4 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing Work of this Section.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data on specified products describing physical and performance characteristics, and color, pattern, and texture options available.

C. Shop Drawings: Submit scaled drawings indicating the following:
   1. Floor areas to receive the Work. Include the colors and patterns for each area.
   2. Indicate walls, floor drains, floor boxes, penetrations, and other surface interruptions.
   3. Indicate floor areas to be sloped and direction of slope.
   4. Indicate locations to receive waterproofing membrane.

5. Indicate locations of substrate expansion, isolation and control joints requiring joint treatment at interface with flooring system; indicate materials to be used at each such joint type.
6. Section detail drawings indicating termination and transition edges at interface with other construction work, key cuts, cove base details, treatments at substrate various joint types and cracks (moving and non-moving), interface with floor drains and other obstructions.

D. Samples for Initial Selection: Two manufacturer's complete sets of color samples illustrating the full range of available finishes, colors, chip and aggregate sizes/colors/blends, resin colors, trim, and accessories; submit for Architect's initial selections. Include sealant colors.

E. Samples for Verification: From the Architect's initial selections, prepare and submit two samples for each selected finish and color; samples to be same product material type indicated for final Work; each sample 8 x 8 inches. Where finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

G. Manufacturer's Qualification Statement.

H. Installer's Qualification Statement.

I. Manufacturer's Installation Instructions: Include procedures for installing each flooring system component, special procedures and perimeter conditions requiring special attention.

1.6 CLOSEOUT SUBMITTALS

A. Section 01 77 00 - Closeout Procedures.

B. Operation and Maintenance Data: Include maintenance procedures, recommended maintenance materials, procedures for stain removal, repairing surface, and suggested schedule for cleaning.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this Section with minimum five (5) years documented experience.

B. Installer Qualifications: Company specializing in performing the Work of this Section with minimum five (5) years of documented experience and approved by product manufacturer.
1. Supervisor Qualifications: Trained by product manufacturer.

C. Source Limitations: Obtain primary flooring system materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single manufacturer. Obtain secondary flooring system materials, including patching and fill material, joint sealant, and repair materials, of type and from manufacturer recommended in writing by manufacturer of primary materials.

D. Flooring systems are to comply with applicable requirements of United States Department of Agriculture (USDA), Food and Drug Administration (FDA), and local Health Department.

1.8 MOCKUP

A. Section 01 40 00 - Quality Requirements: Requirements for mockup.

B. Locate where directed by Architect.

C. Construct mockup, 10 x 10 feet, including flooring, base, and accessories to illustrate appearance of finished Work.

D. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

E. Subject to compliance with requirements, approved mockups may become part of the completed Work if undamaged at time of Final Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Store materials in accordance with manufacturer's recommendations but not less stringent than the following:
   1. Maintain minimum temperature in storage area of 55 degrees F (13 degrees C).
   2. Store materials in area of installation for minimum period of 24 hours prior to installation.
   3. Maintain ambient temperature required by manufacturer 72 hours prior to, during, and 24 hours after installation of materials.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Maintain ambient temperature required by manufacturer 72 hours prior to installation, during installation, and 24 hours after floor system has cured.

C. Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.

D. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.

E. Close spaces to traffic during resinous flooring application and for 24 hours after application unless manufacturer recommends a longer period.

1.11 SPARE PARTS AND MAINTENANCE PRODUCTS

A. Section 01 60 00 - Product Requirements: Extra materials, spare parts, and maintenance products.
   1. Supply quantities of flooring system materials to fully install 30 sq ft of each flooring system type, color, and finish installed. Materials are to be packaged and sealed by manufacturer in quantities required to produce floor systems matching those installed.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers:
   1. Dex-O-Tex.
   2. Dur-A-Flex, Inc.
   3. Sherwin-Williams.
   4. Sika.
   5. Stonhard, Inc.
   6. Substitutions: Section 01 60 00 - Product Requirements.

2.2 RESINOUS FLOORING SYSTEMS

A. Resinous Flooring **Type RSF1**: Application locations as indicated on Drawings
   1. Basis of Design: Dur-A-Flex, Inc. - Hybri-Flex EC System.
   2. System Thickness: 3/16 inch thick.
   3. Components:
      a. Primer: Polyurethane based. (Poly-Crete TF Plus)
      b. Base Coat: Cementitious urethane based, with fine aggregate. (Poly-Crete SL)
         1) Broadcast: Vinyl Chips.
            a) Micro size.
      c. Broadcast Coat: Epoxy based. (Dur-A-Glaze #4)
         1) Broadcast: Vinyl Chips.
            a) Micro size.
      d. Grout Coat: Epoxy based. (Dur-A-Glaze #4)
         1) Slip Resistant Grit: 36 grit aluminum oxide, white. (Dur-A-Grit #36)
      e. Topcoat: Aliphatic urethane based. (Armor Top)
   4. Finish Appearance:
      a. Color:
         1) As indicated on Drawings.
      b. Sheen:
         1) To be selected by Architect from manufacturer's full range.
      c. Texture:
         1) Slip resistant.
   5. Resinous Base: Match resinous flooring; seamless with radius cove integral to resinous flooring material. No slip resistant grit required.
      a. Base Height:
         1) 4 inches unless indicated otherwise on Drawings.
      b. Base Top:
         1) Zinc metal angle trim sized for thickness of resinous base for termination and protection of top edge of resinous base. To be installed as integral part of resinous base.

B. Accessories:
   1. Waterproofing Membrane: Type recommended by resinous flooring system manufacturer for substrate and flooring system component materials to be installed.
   2. Reinforcing Membrane: Type recommended by resinous flooring system manufacturer for substrate and flooring system component materials to be installed.
   3. Subfloor Fillers: Types recommended by resinous flooring system manufacturer, specific to the filling, sloping or patching conditions.
   4. Primers and Adhesives: Waterproof types recommended by resinous flooring system manufacturer.
   5. Joint Sealant: Type recommended or produced by resinous flooring system manufacturer for type of flooring system finish performance, user traffic, service and joint condition indicated.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 73 00 - Execution: Verification of existing conditions before starting Work.

B. Verify existing conditions are as required before starting Work of the Section.

C. Verify the installed and finished floor system of this Section will finish flush with the finished level of floor boxes, inserts, devices, and adjacent floors. This flush transition

requirement cannot be over emphasized. The transition joints must be tight and flush to eliminate trip hazards.

D. Verify floor boxes, inserts, utilities, and other floor devices are installed in correct locations.

E. Verify floor drains are installed, properly aligned, and are at finish elevations to allow flooring application to slope to drains.
   1. If floor drains are rectangular in shape, verify that the sides are properly aligned with room features such as dominate walls unless otherwise indicated on Drawings.

F. Verify all adjacent work, including flooring by others, is completed and that overhead work trades have finished their work in the flooring areas.

G. Verify building is dry, all openings are closed in, adequate ventilation is provided, and permanent heating and air conditioning is installed operating and providing the required conditioning of the air in the work area.

H. Verify substrates are 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.

I. Verify concrete substrate finishes have been steel troweled to a true level and finished smooth and straight to a tolerance of 1/4 inch in a 10 foot radius. High spots are to be ground level and low spots filled in with approved leveling compounds to achieve the required elevation and level flatness.
   1. Sloped Concrete: Levelness is relative to slopes indicated including slopes to drains.

J. Verify wall surfaces are flat within the tolerances specified for that type of work.

K. Verify concrete substrates are dry in accordance with industry standard testing procedures.

L. Verify substrates are free of dust, debris, and deleterious matter.

M. Cementitious Substrate Surfaces Testing: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).
   1. Alkalinity (pH) Testing: ASTM F710. Measurement for pH range is to be not less than 7 pH and not more than 9 pH, unless written recommendations of flooring manufacturer or adhesive manufacturer are more stringent.
   2. Internal Relative Humidity Testing: ASTM F2170. Perform test using in situ probes. Humidity level of substrates is to measure no more than 75 percent relative humidity level unless written recommendations of flooring manufacturer or adhesive manufacturer are more stringent.
   3. Moisture Vapor Emission Testing: ASTM F1869. Perform anhydrous calcium chloride test. Moisture vapor emission rate (MVER) from the slab is to be less than or equal to 3 lbs of water per 1,000 sf in 24 hours unless written recommendations of flooring manufacturer or adhesive manufacturer are more stringent.
   4. Conduct tests by an independent testing agency acceptable to Owner.

N. Do not proceed with installation Work until noncompliant conditions have been corrected.

3.2 PREPARATION

A. Section 01 73 00 - Execution: Prepare field conditions and existing construction for installation of Work of this Section.

B. Prepare materials to be installed and equipment to be used during installation.

C. Concrete surfaces shall be free of oil, grease, curing compounds, loose particles, moss, algae growth, laitance, friable matter, dirt, and bituminous products.

D. Mechanical Surface Preparation: Perform preparation on substrate as recommended by manufacturer and as follows.
   1. Shot blast all surfaces to receive flooring system with a mobile steel shot, dust recycling machine (Blastrac or equal). All surface and embedded accumulations of paint, toppings hardened concrete layers, laitance, power trowel finishes, and other similar surface characteristics shall be completely removed leaving a bare concrete surface having a minimum profile of CSP 4-5 in accordance with ICRI 310.2R.
   2. Floor areas inaccessible to the mobile blast machines shall be mechanically abraded to the same degree of cleanliness, soundness and profile using diamond grinders, needle guns, bush hammers, or other suitable equipment.
   3. Where the perimeter of the substrate to be coated is not adjacent to a wall or curb, a minimum 1/4 inch key cut shall be made to properly seat the system, providing a smooth transition between areas. The detail cut shall also apply to drain perimeters and expansion joint edges.
   4. Remove substrate ridges and bumps.
   5. Treat non-moving cracks and joints to prevent cracks from reflecting through the flooring system. Perform treatments and repairs in accordance with flooring system manufacturer’s recommendations.

E. At spalled or worn areas, mechanically remove loose or delaminated concrete to a sound concrete and patch per manufactures recommendations.

F. Apply subfloor filler in accordance with manufacturer's recommendations to fill depressions, minor holes, and to slope floors away from walls and toward floor drains if floor drains are present.
   1. Apply, trowel, and float subfloor filler to achieve smooth, flat, hard surface. Grind irregularities above surface level. Prohibit traffic until filler is cured.

G. Clean substrate.

3.3 INSTALLATION

A. Section 01 73 00 - Execution: Related to installation of Work.

B. Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.
   1. Apply each coat of flooring system at thickness recommended by flooring system manufacturer.
   2. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
   3. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
   4. Expansion, Isolation and Control Joint Treatment: At substrate expansion and isolation joints, comply with resinous flooring manufacturer's written instructions and details for each joint type and condition. Apply joint sealant to comply with manufacturer's written recommendations.

C. Primer: Apply primer over prepared substrate at manufacturer's recommended spreading rate.
   1. Coordinate use of primer with flooring system manufacturer recommendations at locations where waterproofing membrane and reinforcing membrane are installed.

D. Waterproofing Membrane: At locations indicated, apply waterproofing membrane over entire substrate surface and including behind integral cove base. Comply with flooring system manufacturer's recommendations for application and thickness.
   1. Locations: Elevated floors, shower areas, and other locations indicated on Drawings.

E. Reinforcing Membrane:
   1. Apply reinforcing membrane to non-moving cracks and joints.

F. Integral Cove Base: Apply cove base mix to wall surfaces before applying flooring. Apply according to manufacturer's written instructions and details, including those for taping, mixing, priming, troweling, sanding, and topcoating of cove base. Round internal and external corners. Transitions in planes, terminations, abutments, and cove formed base are to be carefully crafted with accurate lines and smooth contouring.

3.4 ERECTION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation from Flat Surface: 1/4 inch in 10 feet.

C. Maximum Variation from Level: 1/8 inch.
   1. Sloped Concrete: Levelness is relative to slopes indicated including slopes to drains.

3.5 CLEANING

A. Section 01 73 00 - Execution and Section 01 77 00 - Closeout Procedures: Clean installed Work and comply with manufacturer’s recommendations.

B. Clean installed Work in accordance with manufacturer’s recommended materials and procedures.

3.6 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 73 00 - Execution: Protecting installed construction.

B. Prohibit traffic on floor finish until cured; barricade as required.

C. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring system manufacturer.

END OF SECTION

Construction Documents 6/12/24

SECTION 09 68 13
TILE CARPETING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Tile carpeting.
2. Accessories.

B. Related Requirements:
1. Section 03 30 00 - Cast-In-Place Concrete: Flooring substrate.
2. Section 09 65 00 - Resilient Flooring: Wall base.

1.2 REFERENCES

A. American Association of Textile Chemists and Colorists (AATCC):
1. AATCC 134 - Test Method for Electrostatic Propensity of Carpets; 2019.
2. AATCC 174 - Test Method for Antimicrobial Activity Assessment of New Carpets; 2022, Editorial Changes 2023.

B. ASTM International (ASTM):
1. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 2023.
2. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials; 2016, Reapproval 2021.
3. ASTM D5116 - Standard Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/Products; 2017.
4. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2023.
5. ASTM E662 - Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials; 2021a.
6. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.
7. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2023.
8. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.

C. Carpet and Rug Institute (CRI):
1. CRI 104 - Standard for Installation of Commercial Carpet; 2015.
2. CRI (GLP) - Green Label Plus Testing Program - Certified Products; Current Edition.

D. National Fire Protection Association (NFPA):
1. NFPA 253 - Standard Method of Test for Critical Radiant Flux for Floor Covering Systems Using a Radiant Heat Energy Source; 2023.

1.3 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this Section. Review the work requirements, application procedures, quality control, testing and inspection and production schedule.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

C. Shop Drawings: Indicate layout of joints, direction of carpet tiles, location of moldings and transition edge strips.

D. Samples for Initial Selection: Two manufacturer's complete sets of color samples illustrating the full range of colors, textures and pattern designs available; submit for Architect's initial selections. Include 6 inches long samples of moldings and transition edge strips.

E. Samples for Verification: From the Architect's initial selections, prepare and submit two samples for each selected colors, textures, and pattern designs; samples to be same product material type indicated for final Work; each sample 12 x 12 inches. Where finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.

F. Manufacturer's Installation Instructions: Submit special procedures, perimeter conditions requiring special attention.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 77 00 - Closeout Procedures.

B. Operation and Maintenance Data: Submit maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this Section with minimum five (5) years documented experience.

B. Installer Qualifications: Company specializing in performing work of this Section with minimum three (3) years documented experience and approved by carpet manufacturer.

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

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Store materials in compliance with the manufacturer's recommendations.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Requirements before, during and after Work.

B. Do not install the work of this Section until wet construction work is complete and permanent heat and air conditioning is installed and operating.

C. Maintain room temperature and humidity levels prior to installation in accordance with manufacturer's recommendations.

D. Acclimate flooring materials by storing materials in conditioned installation area prior to installation for period recommended by manufacturer, but not less 48 hours.

1.9 WARRANTIES

A. Section 01 77 00 - Closeout Procedures: Product warranties.

B. Carpet Tile: Provide manufacturer's warranties covering the following:
   1. Lifetime Commercial Limited Warranty: Includes coverage for Fiber Abrasive Wear, Fiber Static Protection, Fiber Stain Warranty, Fiber Colorfastness to Light and Fiber Atmospheric Contaminants.

1.10 SPARE PARTS AND MAINTENANCE PRODUCTS

A. Section 01 60 00 - Product Requirements: Extra materials, spare parts, and maintenance products.
   1. Supply 100 square feet of carpet tiles of each pattern and color installed.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Materials to comply with the following independently tested performance criteria:
   1. Surface Flammability Ignition: Pass ASTM D2859 (the "pill test").
   2. Critical Radiant Flux (CRF): In compliance with ASTM E648 or NFPA 253.
      a. Class I, minimum 0.45 watt per square centimeter.
   3. Smoke Density: 450 or less in accordance with ASTM E662.
   4. Noise Reduction Coefficient: NRC Rating 0.30 (ASTM C423).
   5. Slip Resistance: Comply with ADA Guidelines.
   6. VOC: Carpet certified as passing the CRI (GLP) indoor air quality testing program.
   7. Dimensional Stability: 0.1 % or less change Stability (Aachen Method Din 54318)
   8. Static Generation:
      a. 3.5 kV or less at 20% R.H. at 70º F (AATCC 134 w/ neolite).
   9. Antimicrobial: Broad spectrum antimicrobial; permanent application in backing. Application must pass AATCC 174.
   10. VOC Limits: Provide carpet tile that complies with the following limits for VOC content when tested according to ASTM D5116:
      a. Total VOCs: 0.5 mg/sq. m x h.
      b. 4-PC (4-Phenylcyclohexene): 0.05 mg/sq. m x h.
      c. Formaldehyde: 0.05 mg/sq. m x h.
      d. Styrene: 0.4 mg/sq. m x h.
   11. Adhesive: Comply with the following criteria unless the manufacturer's warranty requirements indicate otherwise.
      a. Water-resistant, mildew-resistant, non-staining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.
      b. Adhesive VOC Limits: Provide adhesives that comply with the following limits for VOC content when tested according to ASTM D5116:
         1) Total VOCs: 10.00 mg/sq. m x h.
         2) Formaldehyde: 0.05 mg/sq. m x h.
         3) 2-Ethyl-1-Hexanol: 3.00 mg/sq. m x h.

2.2 CARPET TILE

A. Carpet Tile **Type CPT1**: Manufactured in one color dye lot; conforming to the following criteria:

1. Basis of Design: Tarkett – Flame Edit 11612 - Ballast 22412 – 24” x 24” – installed vertical ashlar
2. Alternate 1 – Patcraft – Organic Interruption Collection – Linear Tension 10541 – Asphalt 000590 – 18”x36” – installed vertical ashlar.
3. Alternate 2 – Mohawk – Textural Effects Collection – Thematic Thread – Charcoal 989 – 12” x 36” – Installed monolithic

B. Carpet Tile **Type CPT2**: Manufactured in one color dye lot; conforming to the following criteria:
1. Basis of Design: Tarkett – Flame Edit 11612 – Common Ground 22404 – 24” x 24” – installed vertical ashlar
2. Alternate 1 – Patcraft – Organic Interruption Collection – Linear Tension 10541 – Bark 00070 – 18”x36” – installed vertical ashlar.
3. Alternate 2 – Mohawk – Textural Effects Collection – Thematic Thread – Concrete 968 – 12” x 36” – Installed monolithic

C. Carpet Tile **Type CPT3**: Manufactured in one color dye lot; conforming to the following criteria:
1. Basis of Design: Tarkett – Create Balance – custom color 114812942-190 – 18”x36” – installed vertical ashlar.
2. Alternate 1 – Patcraft – Organic Interruption Collection – Linear Tension 10541 – Sunbeam 00250 – 18”x36” – installed vertical ashlar.
3. Alternate 2 – Mohawk – Lichen Community Collection – Macro Bloom II GT474 – Gold Dust Bark 831- 24” x 36” – installed vertical ashlar.

D. Carpet Tile **Type CPT4**: Manufactured in one color dye lot; conforming to the following criteria:
1. Basis of Design: Tarkett – Assertive Action 04837 – Chromium 26201 – 24”x24” – install quarter turn.
2. Alternate 1 – Patcraft – Entry Esthetic – Winter Mix 00570 – 18”x36” – install ashlar.
3. Alternate 2 – Mohawk – Architect to select from manufacturer’s full range.

2.3 WALL BASE

A. Wall Base Type: As indicated in Section 09 65 00 - Resilient Flooring.
1. Color: As selected by Architect from samples submitted under Section 09 65 00.

2.4 ACCESSORIES

A. Sub-Floor Filler: Factory mixed latex type recommended by manufacturers of flooring and adhesive materials and compatible with substrate materials and conditions.

B. Primers and Adhesives: Water-resistive type recommended by manufacturer of flooring material and compatible with substrate materials and conditions.

C. Moldings, Transition, and Edge Strips:
1. Rubber: Colors and profiles to be selected by Architect from manufacturer's full range.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 73 00 - Execution: Verification of existing conditions before starting work.

B. Verify compliance with the requirements in the PART 1, ENVIRONMENTAL REQUIREMENTS article.

C. Verify that existing conditions are as required before starting work of the Section.

D. Verify that the assembled and finished floor system of this Section will finish flush with floor boxes, inserts, devices, and adjacent finished floors. This flush transition requirement cannot be over emphasized. The transition joints must be tight and flush to eliminate trip hazards.

E. Verify that floor boxes, inserts, utilities, and other floor devices are installed in correct locations.

F. Verify that overhead work trades have finished their work in the flooring areas.

G. Verify that the building is dry, all openings are closed in, adequate ventilation is provided, and permanent heating and air conditioning is installed operating and providing the required conditioning of the air in the work area.

H. Verify that surfaces are 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.

I. Verify that the concrete finish has been steel troweled to a true level and finished smooth and straight to a tolerance of 1/4 inch in a 10 foot radius. High spots are to be ground level and low spots filled in with approved leveling compounds to achieve the required elevation and level flatness.

J. 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 wall base material.

K. Verify that the concrete substrate is dry in accordance with industry standard testing procedures, free of foreign materials, and broom cleaned.

L. Cementitious Substrate Surfaces Testing: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).
   1. Alkalinity (pH) Testing: ASTM F710. Measurement for pH range is to be not less than 7 pH and not more than 9 pH, unless written recommendations of flooring manufacturer or adhesive manufacturer are more stringent.
   2. Internal Relative Humidity Testing: ASTM F2170. Perform test using in situ probes. Humidity level of substrates is to measure no more than 75 percent relative humidity level, unless written recommendations of flooring manufacturer or adhesive manufacturer are more stringent.
   3. Moisture Vapor Emission Testing: ASTM F1869. Perform anhydrous calcium chloride test. Moisture vapor emission rate (MVER) from the slab is to be less than or equal to 3 lbs of water per 1,000 sf in 24 hours, unless written recommendations of flooring manufacturer or adhesive manufacturer are more stringent.
   4. Conduct tests by an independent testing agency acceptable to Owner.

M. Do not proceed with installation work until noncompliant conditions have been corrected.

3.2 PREPARATION

A. Section 01 73 00 - Execution: Prepare field conditions and existing construction for installation of work of this Section.

B. Prepare materials to be installed and equipment to be used during installation.

C. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler.

D. Apply filler. Trowel and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.

E. Clean substrate.

3.3 INSTALLATION

A. Section 01 73 00 - Execution: Related to installation of Work.

B. Comply with CRI 104 and manufacturer's recommendations.

C. Do not mix carpet from different cartons unless from same dye lot.

D. Cut carpet clean. Fit carpet tight to intersection with vertical surfaces without gaps.

E. Locate change of color or pattern between rooms under door centerline.

F. Fully adhere carpet tile to substrate using adhesives and instructions in accordance with carpet manufacturer's recommendations.

G. Trim carpet neatly at walls and around interruptions.

H. Complete installation of moldings and transition edge strips, concealing exposed edges.

I. Install wall base.

3.4 CLEANING

A. Section 01 73 00 - Execution and Section 01 77 00 - Closeout Procedures: Related to cleaning.

B. Remove excess adhesive from floor, base, and wall surfaces without damage.

C. Clean and vacuum carpet surfaces.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 73 00 - Execution: Protecting installed construction.

B. Protect installed construction from damage and soiling.

END OF SECTION

SECTION 09 68 16

SHEET CARPETING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Sheet carpeting.
   2. Accessories.

B. Related Requirements:
   1. Section 03 30 00 - Cast-In-Place Concrete: Flooring substrate.
   2. Section 09 65 00 - Resilient Flooring: Wall base.
   3. Section 09 68 13 - Tile Carpeting.

1.2 REFERENCES

A. Americans with Disabilities Act (ADA):
   1. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; Current Edition.

B. American Association of Textile Chemists and Colorists (AATCC):
   1. AATCC 134 - Test Method for Electrostatic Propensity of Carpets; 2019.
   2. AATCC 174 - Test Method for Antimicrobial Activity Assessment of New Carpets; 2022, with Editorial Revision 2023.

C. ASTM International (ASTM):
   1. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 2023.
   2. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials; 2016, Reapproval 2021.
   3. ASTM D5116 - Standard Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/Products; 2017.
   4. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2023.
   5. ASTM E662 - Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials; 2021a.
   6. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.
   7. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2023.
   8. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.

D. Carpet and Rug Institute (CRI):
   1. CRI 104 - Standard for Installation of Commercial Carpet; 2015.
   2. CRI (GLP) - Green Label Plus Testing Program - Certified Products; Current Edition.

E. Code of Federal Regulations (CFR):
   1. 16 CFR 1630 - Standard for the Surface Flammability of Carpets and Rugs; Current Edition.

F. National Fire Protection Association (NFPA):
   1. NFPA 253 - Standard Method of Test for Critical Radiant Flux for Floor Covering Systems Using a Radiant Heat Energy Source; 2023.

1.3 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this Section. Review the work requirements, application procedures, quality control, testing and inspection and production schedule.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

C. Shop Drawings: Indicate layout of joints, direction of carpet pile, location of edge moldings.

D. Samples for Initial Selection: Two manufacturer's complete sets of color samples illustrating the full range of colors, textures and pattern designs available; submit for Architect's initial selections. Include 6 inches long samples of moldings and transition edge strips.

E. Samples for Verification: From the Architect's initial selections, prepare and submit two samples for each selected colors, textures, and pattern designs; samples to be same product material type indicated for final Work; each sample 12 x 12 inches. Where finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.

F. Manufacturer's Installation Instructions: Submit special procedures, perimeter conditions requiring special attention.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 77 00 - Closeout Procedures.

B. Operation and Maintenance Data: Submit maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this Section with minimum five (5) years documented experience.

B. Installer Qualifications: Company specializing in performing work of this Section with minimum three (3) years documented experience and approved by carpet manufacturer.

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

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Store materials in compliance with the manufacturer's recommendations.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Requirements before, during and after Work.

B. Do not install the work of this Section until wet construction work is complete and permanent heat and air conditioning is installed and operating.

C. Maintain room temperature and humidity levels prior to installation in accordance with manufacturer's recommendations.

D. Acclimate flooring materials by storing materials in conditioned installation area prior to installation for period recommended by manufacturer, but not less 48 hours.

1.9 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish Flooring Contractor's ten (10) year warranty for defects in materials and workmanship.

C. Furnish manufacturer's standard warranties covering the following:
1. Lifetime Limited Warranty: Includes coverage for Face Wear, Moisture Barrier, Wick-Back, Delamination, Tuft Bind, Unraveling, and Static Protection.
2. Fifteen (15) Year Limited Warranty Against Color Loss from Bleach Spills.
3. Fifteen (15) Year Limited Warranty Against Staining.

1.10 SPARE PARTS AND MAINTENANCE PRODUCTS

A. Section 01 60 00 - Product Requirements: Extra materials, spare parts, and maintenance products.
1. Supply two (2) percent of each carpet color and pattern selected for the project.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Materials to comply with the following independently tested performance criteria:
1. Surface Flammability Ignition: Pass ASTM D2859 (the "pill test") or 16 CFR 1630.
2. Critical Radiant Flux (CRF): In compliance with ASTM E648 or NFPA 253.
   a. Class I, minimum 0.45 watt per square centimeter.
3. Smoke Density: 450 or less in accordance with ASTM E662.
4. Slip Resistance: Comply with ADA Guidelines.
5. VOC: Carpet certified as passing the CRI (GLP) indoor air quality testing program.
6. Dimensional Stability: 0.1 % or less change Stability (Aachen Method Din 54318)
7. Static Generation:
   a. 3.0 kV or less at 20% R.H. at 70º F (AATCC 134 w/ neolite).
8. Antimicrobial: Broad spectrum antimicrobial; permanent application in backing. Application must pass AATCC 174.
9. VOC Limits: Provide carpet tile that complies with the following limits for VOC content when tested according to ASTM D5116:
   a. Total VOCs: 0.5 mg/sq. m x h.
   b. 4-PC (4-Phenylcyclohexene): 0.05 mg/sq. m x h.
   c. Formaldehyde: 0.05 mg/sq. m x h.
   d. Styrene: 0.4 mg/sq. m x h.
10. Adhesive: Comply with the following criteria unless the manufacturer's warranty requirements indicate otherwise.
    a. Water-resistant, mildew-resistant, non-staining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.

b. Adhesive VOC Limits: Provide adhesives that comply with the following limits for VOC content when tested according to ASTM D5116:
   1) Total VOCs: 10.00 mg/sq. m x h.
   2) Formaldehyde: 0.05 mg/sq. m x h.
   3) 2-Ethyl-1-Hexanol: 3.00 mg/sq. m x h.

2.2 SHEET CARPET

A. Sheet Carpet **Type CP1**: Manufactured in one color dye lot, conforming to the following criteria:
   1. Basis of Design: Tarkett – Create Balance – Powerbond Cushion - custom color 114812942-190 – 6’ roll width
   2. Alternate 1: EF Contract Flooring – Kinetix – Architect to select from manufacturer’s full range
   3. Alternate 2: Forbo – Flotex - Architect to select from manufacturer's full range

2.3 ACCESSORIES

A. Sub-Floor Filler: Factory mixed latex type recommended by manufacturers of flooring and adhesive materials and compatible with substrate materials and conditions.

B. Primers and Adhesives: Water-resistive type recommended by manufacturer of flooring material and compatible with substrate materials and conditions.

C. Moldings, Transition, and Edge Strips:
   1. Extruded Aluminum: Mechanically fastened to the sub floor. Glue-down strips are not allowed.
      a. Colors and profiles to be selected by Architect from manufacturer's full range.

D. Provide banding for all exposed carpet edges.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 73 00 - Execution: Verification of existing conditions before starting work.

B. Verify compliance with the requirements indicated in ENVIRONMENTAL REQUIREMENTS article.

C. Verify that existing conditions are as required before starting work of the Section.

D. Verify that the assembled and finished floor system of this Section will finish flush with floor boxes, inserts, devices, and adjacent finished floors. This flush transition requirement cannot be over emphasized. The transition joints must be tight and flush to eliminate trip hazards.

E. Verify that floor boxes, inserts, utilities, and other floor devices are installed in correct locations.

F. Verify that overhead work trades have finished their work in the flooring areas.

G. Verify that the building is dry, all openings are closed in, adequate ventilation is provided, and permanent heating and air conditioning is installed operating and providing the required conditioning of the air in the work area.

H. Verify that surfaces are 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.

I. Verify that the concrete finish has been steel troweled to a true level and finished smooth and straight to a tolerance of 1/4 inch in a 10 foot radius. High spots are to be ground level and low spots filled in with approved leveling compounds to achieve the required elevation and level flatness.

J. 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 wall base material.

K. Verify that the concrete substrate is dry in accordance with industry standard testing procedures, free of foreign materials, and broom cleaned.

L. Cementitious Substrate Surfaces Testing: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).
1. Alkalinity (pH) Testing: ASTM F710. Measurement for pH range is to be not less than 7 pH and not more than 9 pH, unless written recommendations of flooring manufacturer or adhesive manufacturer are more stringent.
2. Internal Relative Humidity Testing: ASTM F2170. Perform test using in situ probes. Humidity level of substrates is to measure no more than 75 percent relative humidity level, unless written recommendations of flooring manufacturer or adhesive manufacturer are more stringent.
3. Moisture Vapor Emission Testing: ASTM F1869. Perform anhydrous calcium chloride test. Moisture vapor emission rate (MVER) from the slab is to be less than or equal to 3 lbs of water per 1,000 sf in 24 hours, unless written recommendations of flooring manufacturer or adhesive manufacturer are more stringent.
4. Conduct tests by an independent testing agency acceptable to Owner.

M. Do not proceed with installation work until noncompliant conditions have been corrected.

3.2 PREPARATION

A. Section 01 73 00 - Execution: Prepare field conditions and existing construction for installation of work of this Section.

B. Prepare materials to be installed and equipment to be used during installation.

C. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler.

D. Filler is to be applied, troweled, and floated to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.

E. Clean substrate.

3.3 INSTALLATION

A. Section 01 73 00 - Execution: Related to installation of Work.

B. Install carpet tile in accordance with CRI 104 and carpet manufacturer.

C. Verify carpet match before cutting to ensure minimal variation between dye lots.

D. Lay out carpet and locate seams in accordance with CRI 104 section 7.2 shop drawings:
1. Locate seams in area of least traffic, out of areas of pivoting traffic, and parallel to main traffic.
2. Do not locate seams perpendicular through door openings.
3. Align run of pile in same direction as anticipated traffic and in same direction on adjacent pieces.
4. Provide monolithic color, pattern, and texture match within each contiguous area.

E. Install carpet tight and flat on subfloor, well fastened at edges, with uniform appearance.

F. Double cut carpet seams, with accurate pattern match. Make cuts straight, true, and unfrayed. Apply seam adhesive to cut edges of woven carpet immediately.
   1. Seam sealer is required at all seams.

G. Direct Glue-Down Installation: CRI 104 Section 8.
   1. Apply contact adhesive to floor uniformly at rate recommended by manufacturer. After sufficient open time, press carpet into adhesive.
   2. Apply seam adhesive. Lay adjoining piece with seam straight, not overlapped or peaked, and free of gaps.
   3. Roll with appropriate roller for complete contact of adhesive to carpet backing.

H. Trim carpet neatly at walls and around interruptions.
   1. No saddle or T-seams shall be allowed in doorways or high traffic areas.

I. Complete installation of moldings and transition edge strips, concealing exposed edges.

J. Install wall base.

K. Complete installation of edge strips, concealing exposed edges.

3.4 CLEANING

A. Section 01 73 00 - Execution and Section 01 77 00 - Closeout Procedures: Clean installed work in accordance with manufacturer's recommendations including cleaning procedures and materials.

B. Remove excess adhesive from floor, base, and wall surfaces without damage.

C. Clean and vacuum carpet surfaces.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 73 00 - Execution: Protecting installed construction.

B. Ventilate thoroughly all carpeted areas during and after installation, prior to occupancy.

C. Protect the work against damage from construction operations and placement of equipment.

END OF SECTION

SECTION 09 84 00

ACOUSTIC ROOM COMPONENTS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Wall mounted acoustical panels.
   2. Ceiling mounted acoustical panels.
   3. Preformed acoustic partition closures and fillers.

B. Related Requirements:
   1. Section 09 51 13 - Acoustical Panel Ceilings: General purpose acoustical ceiling panels and grids serving as supports for ceiling mounted acoustical panels specified in this Section.

1.2 REFERENCES

A. American Society of Civil Engineers (ASCE):
   1. 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 International (ASTM):
   1. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 2023.
   2. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.
   3. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
   4. ASTM E795 - Practices for Mounting Test Specimens During Sound Absorption Tests; 2023.
   5. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2023.

C. Underwriters Laboratories, Inc. (UL):
   1. UL 723 - UL Standard for Safety Test for Surface Burning Characteristics of Building Materials; 2018, Revisions 2023.

1.3 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

B. Coordinate requirements for blocking and support with substrate construction to receive the Work of this Section.

C. Coordinate requirements for ceiling mounted acoustical panels with substrate and framing members of ceiling type to which acoustical panels are to be installed. Coordinate to ensure proper fit and mounting of panels without gaps or uneven alignment.

D. Coordinate work with locations of electrical, fire, and safety devices to avoid conflicts.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal requirements.

B. Product Data: Manufacturer's data sheets, installation instructions, and maintenance recommendations for each type of acoustical panel.

1. Include data indicating coefficients of absorption and Sabines per unit for each type of panel used in the analysis and proposed design layout.

C. Shop Drawings: Prepared by manufacturer. Include elevations showing acoustic room components sizes, arrangements, and details of each condition of installation. Show fabrication and installation details.

D. Samples – Acoustical Panels:
1. Samples for Initial Selection: Two manufacturer's complete set of color charts illustrating the full range of finishes and colors available; include 12 x 12 inches typical panel with mounting hardware; submit for Architect's initial selections.
2. Samples for Verification: From the Architect's initial selections, prepare and submit two samples for each finish and color; each sample to be 12 x12 inches illustrating actual panel construction with mounting hardware. Where finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.

E. Samples - Preformed Acoustic Partition Closure:
1. Samples for Initial Selection: Two manufacturer's complete set of color charts illustrating a minimum of 26 colors for the outer coating finish; include 4 x 4 x 2 inches closure product samples with finish coating applied to 3 sides. Submit for Architect's initial selections.
2. Samples for Verification: From the Architect's initial selections, prepare and submit two samples for each finish and color; each sample to be 4 x 4 inches illustrating actual outer coating material, thickness, color, and finish. Where finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.

F. Product Test Reports: Indicating compliance of products with requirements, from a qualified independent testing agency.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five (5) years documented experience.

B. Installer: Company specializing in performing work of this section with minimum three (3) years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Comply with recommendations of the manufacturers of the products to be used for the Work of this Section.

C. Deliver, store, and handle acoustic panels in accordance with product manufacturer's recommendations. Ship to jobsite only after roughing-in, painting work, and other related finish work has been completed, installation areas are ready to accept units, and manufacturers' recommended temperature and humidity levels will be maintained during the remainder of construction.

1.7 WARRANTY

A. Section 01 77 00 - Closeout Procedures: Product warranties.

B. Submit Manufacturer's written warranty for repair or replacement of acoustical panels that fail in materials or workmanship within five (5) years from date of Substantial Completion. Failures are defined to include, but are not limited to, the following:
   1. Fracturing or breaking of unit components which results from normal wear and tear and normal use other than vandalism.
   2. Delamination or other failures of glue bond of components.
   3. Warping of components not resulting from leaks, flooding, or other uncontrolled moisture or humidity.
   4. Failure of unit to perform acoustically in accordance with manufacturer's published data.

C. Special Warranty:
   1. Cementitious Wood Fiber Panels Warranty: Submit manufacturer executed written warranty agreeing to repair or replace panels that fail within the warranty period.
      a. Failures include, but are not limited to the following:
         1) Defects in materials or factory workmanship.
      b. Warranty Period: Thirty (30) years from date of substantial completion.
      c. The Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

1.8 SPARE PARTS AND MAINTENANCE PRODUCTS

A. Section 01 60 00 - Product Requirements: Extra materials, spare parts, and maintenance products.
   1. Provide quantity of acoustic panels equal to 5 percent of each type, finish, color, and size installed, but not less than one of each.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire Performance Characteristics:
   1. Comply with ASTM E84 or UL 723, unless otherwise indicated.
      a. Flame Spread Index: 25 or less.
      b. Smoke Developed Index: 450 or less.
   2. Identify products with appropriate UL labeling.

B. Seismic Performance:
   1. Comply with ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads" based upon seismic design criteria indicated.

C. Provide a system of sound absorbing and sound diffusing panels to reduce excess sound energy levels and improve sound distribution throughout the space:
   1. System components, configurations, and locations to be as indicated on Drawings.

2.2 MANUFACTURERS

A. Manufacturers:
   1. Fabric Wrapped Panels
      a. Carnegie Fabrics, LLC.
      b. Decoustics.
      c. Novawall Systems Inc.
      d. RPG Acoustical Systems.

e. Sound Seal.
f. Wenger Corporation.

2. Cementitious Wood Fiber Panels:
a. Acoustic Sonic, Inc.
b. ASI Architectural.
c. Cardinal Acoustics
d. Tectum by Armstrong World Industries, Inc.

3. Substitutions: Section 01 60 00 - Product Requirements.

2.3 ACOUSTICAL PANELS

A. Wall and Ceiling Absorber Panels: (FWP1, FWP2, FWP3) Fabric covering finish laminated to rigid glass-fiber board. Glass-fiber board to have chemically hardened edges.

1. Basis of Design:
a. Per CertainTeed Decoustics

2. Surface Burn Characteristics: Acoustical assemblies to be designed and tested to provide the following surface burning characteristics in accordance with the following:
a. ASTM E84:
1) Type 1A
2) Density 6-7lbs/cu.ft.
3) Flame Spread 25 maximum.
4) Smoke Developed index 450 maximum.

3. Panel Size:
a. Shape, thickness, width, and length indicated on Drawings.

4. Fabrics and Colors:
a. Basis of Design:
1) As indicated on Drawings.

5. Wall Panel Mounting Method: Metal wall bracket with panel-mounted Z-bracket.

B. Cementitious Wood Fiber Panels: (AWP1, AWP2, AWP3, AWP4, AWP5) Provide panels fabricated of excelsior wood fibers bonded with water resistant inorganic hydraulic cement.

1. Basis of Design:
a. Cardinal Acoustics:
1) Cardinal - Direct Attach Acoustical Wall

2. Dimensional Stability/Mold Resistance: No significant mold growth when tested in accordance with ASTM D3273.

3. Surface Burn Characteristics: Acoustical assemblies to be designed and tested to provide the following surface burning characteristics in accordance with the following:
a. ASTM E84:
1) Flame Spread: 0.
2) Smoke Developed: 0.
b. Ceiling Panels: UL Classified Flame Spread.
1) ASTM E1264; Class A.

4. Provide UL labeling indicating panel Surface Burning Characteristics.

5. Provide UL Classified Acoustical Material labeling indicating panel Noise Reduction Coefficient (NRC).

6. Panel applications include the following surface types:
a. Panels for Wall Surfaces.
b. Panels for Ceiling Surfaces.

7. Panels:
a. Panel Thickness:

1) As indicated on Drawings.
b. Panel Edge Profiles:
1) Beveled.
c. Panel Sizes:
1) As indicated on Drawings.
d. Paint:
1) Factory Applied.
a) Color:
(1) As indicated on Drawings.
2) Field Applied.
a) Paint manufacturer, type, and application method to match that used for factory applied coatings.
b) 3 coats to be painted over factory applied coats.
c) Color:
(1) As indicated on Drawings.
e. Surface finished appearance to be uniform from panel to panel.
f. Mounting Types:
a) Types Include:
(1) Mounting type A (Ceiling).
(2) Mounting type C40 (Wall).

8. Supports, Fasteners, and Anchors: To be corrosion resistant and as approved by manufacturer.
9. Touch-Up Paint: Paint manufacturer, type, color, application, and appearance to match finish indicated.
a. Apply to field cut conditions.
b. Apply to exposed fasteners. Use paint products compatible with fastener material and finish for adhesion.

2.4 PREFORMED ACOUSTIC PARTITION CLOSURE

A. Manufacturers:
1. Emseal Joint Systems, LTD.
2. Substitutions: Section 01 60 00 - Product Requirements.

B. Basis of Design: Emseal - QuietJoint.

C. Preformed Acoustic Partition Closure: Flexible, rectangular formed for compression fit and seal; non-mechanical and non-invasively anchored; sound attenuating, fire-resistant, and thermally insulating mass-loaded partition closure for sealing voids and gaps in interior constructed work and assemblies.
1. Locations and Configurations:
a. Locations and configurations to be as indicated on Drawings.
b. Closure/filler nominal thickness (depth) to be as follows unless indicated otherwise on Drawings. Actual size to be slightly larger than the void to be filled as to allow for compression fit, but without warped surface appearance. Actual size to be based on actual field measurements of voids to be filled. Coordinate with manufacturer's recommendations.
1) 2 inches minimum thickness for voids or gaps less than 5 inches wide.
2) 3 inches minimum thickness for voids or gaps 5 to 6 inches wide.
2. Core: Open-cell foam infused with fire resistant acrylic based mass-loading agent.
3. Outer Coating: Factory applied, homogenous and smooth silicone coating with integral color for decorative finish exposed to view.
a. 2-Sided Coating: Outer coating to be on the 2 opposing sides of core. Applications include conditions requiring filler/closure where the 2 coated

opposing sides are exposed to view or cavity, and the 2 uncoated sides are compressed against opaque material construction.

b. 3-Sided Coating: Outer coating to be on 3 adjoining sides of core. Applications include conditions requiring filler/closure between a wall end and translucent or transparent glass.

4. Sound Attenuation: Minimum STC 53 rated at 2 inch seal depth in a STC 56 rated wall when tested in accordance with ASTM E90.
5. Fire Resistance: Smoke and flame spread classification of Class A when tested in accordance with ASTM E84.
6. Closure/Filler Joints: Provide product lengths for joint spacing not less than 10 feet. Installed joints are to be hairline tight and with flush finished surface planes.
7. Colors: To be selected by Architect from manufacturer's color samples.

2.5 ACCESSORIES

A. Provide accessories as required to complete Work in accordance with the Drawings and as recommended by the manufacturer for application conditions.

B. Mounting Devices and Anchors:
1. As required to complete Work in accordance with the Drawings and as recommended by manufacturer.
2. Designed and installed to anchor and withstand loads imposed by installed components.
3. Wall Brackets: Galvanized steel rail configured to accept grooved epoxy buttons or Z-brackets attached to panel corners on concealed side.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 73 00 - Execution: Verification of existing conditions before starting work.

B. Examine acoustical panels installation substrates, supports and surroundings for compliance with requirements for installation securement, tolerances, required overhead clearances, and other existing conditions affecting installation and performance of acoustical panels. Proceed with unit installation upon correction of unsatisfactory conditions.

3.2 PREPARATION

A. Section 01 73 00 - Execution: Prepare field conditions and existing construction for installation of work of this section.

B. Prepare materials to be installed and equipment to be used during installation.

3.3 INSTALLATION

A. Section 01 73 00 - Execution: Related to installation of Work.

B. Install the Work of this Section in accordance with the Drawings and manufacturer’s recommendations.

C. Install acoustical panels plumb, level, true, and as indicated regarding brackets, supports, anchors, and fasteners.

D. Install wall-mounted acoustical panels utilizing corner mounting Z-brackets or grooved buttons and concealed wall brackets. Where indicated, secure units to wall with fasteners along top of unit.

E. Install ceiling-mounted acoustical panels utilizing integral corner mounting brackets and mounting methods applicable to the design requirements.
   1. Ceiling Grid Mounted: Mount and fasten panels to grid using grid clips.
   2. Direct Mounted: Attach directly to substrate using back-mounted clip and exposed fastener.
   3. Suspended: Hang panels plumb and free from structural members. Use carrying channels where structural members cannot be used. Use post-installed anchors in concrete slabs.

F. Install seismic bracing and fastening in accordance with applicable code requirements and as indicated in this Section.

3.4 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Monitor quality of installation, inspection, and testing.

B. Should completed installation fail to meet requirements, Contractor shall make modifications necessary to correct performance and retest room as directed by Architect to indicate compliance, at Contractor's expense.

3.5 CLEANING

A. Section 01 73 00 - Execution and Section 01 77 00 - Closeout Procedures: Related to cleaning.

B. Repair or replace defective Work in a manner acceptable to Architect.

C. Clean unit surfaces. Touch up, refinish, or replace damaged components in a manner acceptable to Architect.

END OF SECTION

Construction Documents 6/12/24

SECTION 09 90 00
PAINTING AND COATING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes surface preparation and field application of painting and coating systems.

B. Related Requirements:
   1. Sections including work indicated to receive painting and coating.

1.2 REFERENCES

A. ASTM International (ASTM):
   1. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2019.
   2. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials; 2020.

B. California Department of Public Health (CDPH):
   1. CDPH Standard Method VOC v1.2 - Standard Method For The Testing And Evaluation Of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers - Version 1.2; 2017.

C. GreenSeal, Inc. (GS):
   1. GreenSeal GS-11 - Standard For Paints, Coatings, Stains, and Sealers; 2021.

D. Painting and Decorating Contractors of America (PDCA):
   1. PDCA - Architectural Painting Specification Manual; Current Edition.

E. Society for Protective Coatings (SSPC):
   1. SSPC V1 (PM1) - Good Painting Practice: Painting Manual Volume 1; 2016.
   2. SSPC V2 (PM2) - Systems and Specifications: Steel Structures Painting Manual Volume 2; 2021.
   3. SSPC SP 13 - Surface Preparation of Concrete; 2018.

1.3 DEFINITIONS

A. Conform to ASTM D16 for interpretation of terms used in this Section.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data on all finishing products.

C. Samples for Initial Selection: Submit two paper chip samples; 2 x 3 inches in size; illustrating range of colors, sheens, and textures available for each surface finishing product indicated; submit for Architect's initial selections.
   1. For clear top coats on stained wood, samples to illustrate range of colors and sheens available as applied to wood species required in construction.
   2. For clear top coats on non-stained wood, samples to illustrate sheens available as applied to wood species required in construction.

D. Samples for Verification: From the Architect's initial selections, prepare and submit two samples for each selected color, sheen, and texture. Where finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.

1. For opaque paint samples, submit each on tempered hardboard; minimum 8 x 8 inches.
2. For clear top coats on stained and non-stained wood; submit each on finished wood species required in construction; minimum 8 x 8 inches.

E. Manufacturer's Installation Instructions: Submit special surface preparation procedures and substrate conditions requiring special attention.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 77 00 - Closeout Procedures.

B. Operation and Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five (5) years documented experience.

B. Applicator: Company specializing in performing work of this section with minimum ten (10) years documented experience.

1.7 MOCKUP

A. Section 01 40 00 - Quality Requirements: Mock-up requirements.

B. Construct mockup, in one room, illustrating coating color, sheen, texture, and finish.

C. Locate where directed by Architect.

D. Incorporate accepted mockup as part of Work.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

C. 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.

D. Paint Materials: Store at minimum ambient temperature of 45 degrees F and maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Do not apply materials when surface and ambient temperatures are outside temperature ranges required by paint product manufacturer.

C. Do not apply exterior coatings during rain or snow when relative humidity is outside humidity ranges, or moisture content of surfaces exceed those required by paint product manufacturer.

D. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior, unless required otherwise by manufacturer's instructions.

E. Minimum Application Temperature for Varnish Finishes: 65 degrees F for interior or exterior, unless required otherwise by manufacturer's instructions.

F. Provide lighting level of 80 ft candle measured mid-height at substrate surface.

1.10 WARRANTY

A. Section 01 77 00 - Closeout Procedures: Product warranties.

B. Furnish five (5) year manufacturer warranty for paints and coatings.

C. Contractor to provide a one (1) year warranty on all defects.

D. Installer to provide a two (2) year warranty on all materials and workmanship.

1.11 SPARE PARTS AND MAINTENANCE PRODUCTS

A. Section 01 60 00 - Product Requirements: Extra materials, spare parts, and maintenance products.
   1. Supply 1 gallon of each color, sheen, type, and surface texture; store as directed by Owner.
   2. Label each container with color, sheen, type, surface texture and room locations, in addition to manufacturer's label.

PART 2 PRODUCTS

2.1 PAINTS AND COATINGS

A. Manufacturers:
   1. Benjamin Moore (BM).
   2. PPG Paints (PPG).
   3. Sherwin-Williams Company (SW).
   4. Substitutions: Section 01 60 00 - Product Requirements.

B. Basis of Design Manufacturer (BOD):
   1. Sherwin-Williams Company (SW) unless indicated otherwise as follows:
      a. Comply with SCHEDULE article in PART 3 of this Section if BOD is indicated other than that indicated above.
      b. Comply with Drawings if BOD is indicated other than that indicated in this Section.
      c. Manufacturer, product, and finish sheen to be as indicated in SCHEDULE article in this Section unless indicated otherwise on Drawings.

C. Provide paints and finishes from the same manufacturer to the greatest extent possible.
   1. If a single manufacturer cannot provide specified products, minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.

2.2 COMPONENTS

A. Conditioners, primers, and other undercoating products are to be of same manufacturer as top coat manufacturer unless top coat manufacturer recommends otherwise in writing.

B. All materials and paints shall be lead and mercury free and shall have low VOC content where possible.

C. Coatings: Ready mixed, except field catalyzed coatings. Prepare coatings:
   1. Prepare coatings to soft paste consistency, capable of being readily and uniformly dispersed to homogeneous coating.
   2. Prepare coatings for consistent flow and brushing properties.
   3. Prepare coatings capable of drying and curing free of streaks or sags.

4. Interior Flat and Non-Flat Paints:
   a. Maximum volatile organic compound content in accordance with CDPH Standard Method VOC v1.2.
5. Interior Anti-Corrosive Paints:
   a. Maximum volatile organic compound content in accordance with CDPH Standard Method VOC v1.2.
6. Interior Clear Wood Finishes: Maximum volatile organic compound content in accordance with CDPH Standard Method VOC v1.2.

D. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve finishes specified; commercial quality.
1. Interior Clear Wood Finishes: Maximum volatile organic compound content in accordance with CDPH Standard Method VOC v1.2.

E. Patching Materials: To be compatible with the substrate and paint/coating materials; use latex patching materials where compatible with substrate and paint/coating materials; use tinted or stainable patch materials where wood substrates are indicated to be stained.

F. Recessed Fastener Head Filler Materials: To be compatible with the substrate and paint/coating materials; use latex filler materials where compatible with substrate and paint/coating materials; use tinted or stainable patch materials where wood substrates are indicated to be stained.

2.3 COLORS, SHEENS, AND LOCATIONS FOR APPLICATION

A. Drawings and Schedules on Drawings provide additional information regarding Colors, Sheens, Basis of Design (BOD), and Locations.
1. Other Colors and Locations to be as selected by Architect from manufacturer's full range.

B. Sheen designation indicated on Drawings supersedes sheen designations indicated in this Section.
1. In such case, provide manufacturer and named products indicated in this Section, but with sheen indicated on Drawings.

C. Indicated color codes in this Section and on Drawings are only for the purpose of color matching and does not alter requirements for products, manufacturers, or named products.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 73 00 - Execution: Verification of existing conditions before starting work.

B. Verify surfaces are ready to receive Work as instructed by product manufacturer.

C. Examine surfaces indicated to be finished prior to commencement of work. Report conditions capable of negatively affecting proper application or finished appearance of the work.

D. Test shop applied primer for compatibility with subsequent cover materials.

E. Measure moisture content of surfaces using electronic moisture meter. Do not apply finishes unless moisture content of surfaces is in accordance with the coating manufacturer’s recommendations and is below the following maximums:
1. Gypsum Wallboard: 12 percent.
2. Masonry, Concrete and Concrete Unit Masonry: 12 percent.
3. Interior Wood: 15 percent, measured in accordance with ASTM D4442.

4. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.
5. Concrete Floors and Traffic Surfaces: 8 percent.

3.2 PREPARATION

A. Section 01 73 00 - Execution: Prepare field conditions and existing construction for installation of work of this section. Prepare materials to be installed and equipment used during installation.

B. Preparations to be executed with methods and materials compatible with paints and coatings to be applied.

C. Surface Appurtenances: Remove electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.

D. Surfaces: Correct defects and clean surfaces thoroughly prior to applications.

E. Seal marks and surfaces that might cause bleed through or staining of top coat.

F. Remove marks and foreign matter from substrates indicated for transparent or semi-transparent coatings.

G. Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

H. Aluminum Surfaces Indicated for Paint Finish: Remove surface contamination by steam or high pressure water. Remove oxidation with acid etch and solvent washing. Apply etching primer immediately following cleaning.

I. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.

J. Gypsum Board Surfaces: Must be clean and dry. All nail heads must be set and spackled. Joints must be taped and covered with a joint compound. Spackled fastener heads and tape joints must be sanded smooth, and all dust removed prior to painting. Exterior surfaces must be spackled with exterior grade compounds. Fill minor defects with filler compound. Spot prime defects after repair.

K. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.

L. Concrete: Remove release agents, curing compounds, efflorescence, irregular surfacing, foreign matter, stains, chalk, and laitance. Prepare surface as recommended by finishes manufacturer and according to SSPC SP 13. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds the lesser of that permitted in manufacturer's written instructions and that indicated in this Section. Remove stains caused by weathering of corroding metals with solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

M. Concrete Floors Requiring Sealed Finish (Does not include Polished Concrete Floor Finishing; refer to Division 3):
   1. Use preparation procedures and products as recommended by manufacturer of sealer finish for concrete floors.

N. Masonry Surfaces Indicated to Receive Paint Finish: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

O. Plaster and Parged Surfaces: Fill hairline cracks, small holes, and imperfections with patching material compatible with the plaster and the indicated coatings. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

P. Uncoated Steel and Iron Surfaces: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand power tool wire brushing or sandblasting; clean by washing with solvent. Apply treatment of phosphoric acid solution, ensuring welded joints, bolts, and nuts are similarly cleaned. Spot prime paint after repairs.

Q. Shop Primed Steel 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.

R. Metal Doors and Frames Indicated for Painting: Prime metal door top and bottom edge surfaces.

S. Wood Surfaces:
1. 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. Prime filled areas, sanding between coats. For exterior applications, back prime concealed surfaces of material before installation.
2. Transparent Finish: Wipe off dust and grit prior to application of finishing materials. Fill nail holes and cracks with stainable filler or filler tinted to match the intended final wood appearance. For exterior applications, prime concealed surfaces with indicated finish material.

T. Glue-Laminated Wood Beams Indicated for Field Applied Finishing: Prior to finishing, wash surfaces with solvent, remove grease and dirt.

U. Floor and Roof Concrete Planks: Where underside of planks is exposed to view, install continuous joint sealant materials to seal joints including joints between planks, around perimeters and voids.

V. PVC, Vinyl and Architectural Plastic: Clean and lightly sand surfaces to be coated. Use preparation procedures and products as recommended by substrate manufacturer and manufacturer of coating system.

3.3 APPLICATION

A. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

B. Apply each coat to uniform appearance. Apply each coat of paint slightly darker than preceding coat unless specified otherwise.

C. For concrete masonry units and other porous masonry and cementitious materials indicated to receive painting/coating, apply the primer coating as needed to fill all pinholes prior to applying finish top coats.

D. Sand surfaces lightly between coats to achieve required finish.

E. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

F. Where clear finishes are required, tint fillers to match wood and apply to match wood texture. Remove excess from surface.

G. Prime concealed surfaces of interior woodwork with primer paint.

H. Finishing Mechanical and Electrical Equipment:
1. Paint shop primed equipment. Paint shop finished items occurring at interior areas.

2. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately. Reinstall after paint is cured.
3. Prime and paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, except where items are shop finished.
4. Paint interior surfaces of air ducts visible through grilles and louvers with one coat of flat black paint to visible surfaces. Paint dampers exposed behind louvers, grilles, to match face panels.
5. Paint exposed conduit and electrical equipment occurring in finished areas.
6. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.
7. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

I. Finishing Overhead Construction Indicated as Open To Structure (exposed to view):
1. This provision includes finishing of overhead construction above suspended ceilings and clouds that do not extend to wall. This condition allows overhead construction to be seen above and over the suspended ceiling or cloud. Therefore, such overhead construction must be painted to eliminate unsightly overhead conditions that are visible.
2. This provision does not include mechanical and electrical utility rooms, unless indicated otherwise on Drawings.
3. Apply fast-drying, flat interior dry-fall type alkyd to all overhead construction Work and surfaces. Such surfaces include, but are not limited to, roof decking, structural steel, bracing and supports, and mechanical and electrical work.
   a. Dry-Fall application does not apply to the following:
      1) Items with manufacturer's fully prefinished final coatings such as light fixtures, life safety devices and required warning postings.
      2) Surfaces scheduled to receive manufacturer's fully prefinished final coatings or field applied coatings other than Dry-Fall. Such surfaces may include wood laminated beams and underside of wood plank ceilings.

3.4 CLEANING

A. Section 01 73 00 - Execution and Section 01 77 00 - Closeout Procedures: Related to cleaning.

B. Collect waste material which may constitute fire hazard, place in closed metal containers, and remove daily from site.

3.5 SCHEDULE - EXTERIOR SURFACES

A. Exterior Steel - Unprimed:
1. One coat of alkyd primer.
   a. BM - Super Spec HP Alkyd Metal Primer P06.
   b. PPG - Pitt-Tech Plus 4020 PF DTM Acrylic Primer.
   c. SW - All Surface Enamel Interior-Exterior Alkyd Primer.
2. Two top coats of alkyd enamel finish.
   a. BM - Advance Waterborne Interior-Exterior Alkyd High Gloss N794.
   b. PPG - Pitt-Tech Plus EP DTM Acrylic Gloss.
   c. SW - SWP Exterior Oil Base Gloss.

B. Exterior Steel - Primed:
1. One coat of alkyd primer.
   a. BM - Super Spec HP Alkyd Metal Primer P06.
   b. PPG - Pitt-Tech Plus 4020 PF DTM Acrylic Primer.
   c. SW - All Surface Enamel Interior-Exterior Alkyd Primer.

2. Two top coats of alkyd enamel finish.
    a. BM - Advance Waterborne Interior-Exterior Alkyd High Gloss N794.
    b. PPG - Pitt-Tech Plus EP DTM Acrylic Gloss.
    c. SW - SWP Exterior Oil Base Gloss.

C. Exterior Steel - Primed (Epoxy Coating):
1. One coat of epoxy primer.
    a. BM - Corotech Surface Tolerent Epoxy Mastic V160.
    b. PPG - Amerlock 600 Polyamide Epoxy Coating.
    c. SW - Macropoxy 646 Fast Cure Epoxy Mastic Semi-Gloss.
2. One coat of epoxy body coat.
    a. BM - Corotech Surface Tolerent Epoxy Mastic V160.
    b. PPG - Amerlock 600 Polyamide Epoxy Coating.
    c. SW - Macropoxy 646 Fast Cure Epoxy Mastic Semi-Gloss.
3. One top coat of urethane finish.
    a. BM - Corotech Aliphatic Acrylic Urethane Gloss V500.
    b. PPG - Pitthane Ultra Acrylic Aliphatic Urethane Gloss 95-812 Series.
    c. SW - Hi-Solids Polyurethane Gloss B65-300.

D. Exterior Steel - Galvanized:
1. One coat of alkyd primer.
    a. BM - Ultra Spec HP Acrylic Metal Primer HP04.
    b. PPG - Pitt-Tech Plus 4020 PF DTM Acrylic Primer.
    c. SW - Galvite HS Alkyd Modified Acrylic Primer.
2. Two top coats of alkyd enamel finish.
    a. BM - Advance Waterborne Interior-Exterior Alkyd High Gloss N794.
    b. PPG - Pitt-Tech Plus EP DTM Acrylic Gloss.
    c. SW - SWP Exterior Oil Base Gloss.

E. Exterior Aluminum - Mill Finished:
1. One coat of alkyd primer.
    a. BM - Ultra Spec HP Acrylic Metal Primer HP04.
    b. PPG - Pitt-Tech Plus 4020 PF DTM Acrylic Primer.
    c. SW - Galvite HS Alkyd Modified Acrylic Primer.
2. Two top coats of alkyd enamel finish.
    a. BM - Advance Waterborne Interior-Exterior Alkyd High Gloss N794.
    b. PPG - Pitt-Tech Plus EP DTM Acrylic Gloss.
    c. SW - SWP Exterior Oil Base Gloss.

F. Exterior Concrete Masonry Units:
1. Two coats of block filler.
    a. BM - Ultra Spec Hi-Build Masonry Block Filler 571.
    b. PPG - Speedhide Interior-Exterior Masonry Hi Fill Latex Block Filler.
    c. SW - Loxon Acrylic Block Surfacer A24/LX01 Series.
2. Two top coats of latex finish.
    a. BM - Ultra Spec EXT Finish Satin N448.
    b. PPG - Speedhide Exterior Acrylic Flat.
    c. SW - SuperPaint Exterior Acrylic Latex Flat.

G. Exterior PVC, Vinyl, and Architectural Plastic:
1. One coat of primer.
    a. BM - INSL-X Stix Waterborne Bonding Primer.
    b. PPG - Rust-Oleum XIM UMA Advanced Technology Primer Sealer Bonder.
    c. SW - Extreme Bond Interior-Exterior Bonding Primer.
2. Two top coats of acrylic finish.
    a. BM - Command Waterborne Acrylic Urethane Satin.

b. PPG - Break-Through 50 Interior-Exterior Acrylic Satin.
c. SW - A-100 Exterior Latex Flat.

3.6 SCHEDULE - INTERIOR SURFACES

A. fInterior Concrete Masonry Units:
1. Two coats of block filler unless indicated otherwise.
a. BM - Ultra Spec Hi-Build Masonry Block Filler 571.
b. PPG - Speedhide Interior-Exterior Masonry Hi Fill Latex Block Filler.
c. SW - PrepRite Interior-Exterior Latex Block Filler.
2. Two top coats of latex finish.
a. BM - Ultra Spec 500 Interior Acrylic Finish Semi-Gloss T546.
b. PPG - Speedhide Zero VOC Interior Latex Semi-Gloss.
c. SW - ProMar 200 Zero VOC Interior Latex Semi-Gloss.
3. Special Requirement:
a. Three coats of block filler at following locations.
b. Two top coats of latex finish.
c. Locations:
1) Lobby Areas.
2) Corridors.
3) Stairs Areas.

B. Interior Concrete Masonry Units (Epoxy Coating):
1. Two coats of epoxy block filler, unless otherwise indicated.
a. BM - Corotech Acrylic Block Filler V114.
b. PPG - Speedhide Interior-Exterior Masonry Hi Fill Latex Block Filler 6-15XI.
c. SW - Pro Industrial Heavy Duty Block Filler.
2. Two top coats of acrylic epoxy finish.
a. BM - Corotech Pre-Catalyzed Waterborne Epoxy Semi-Gloss.
b. PPG - Pitt-Glaze WB1 Interior Pre-Catalyzed Acrylic Epoxy Semi-Gloss.
c. SW - Pro Industrial Pre-Catalyzed Waterbased Epoxy Semi-Gloss.
3. Special Requirement:
a. Three coats, minimum, of epoxy block filler.
b. Two top coats, minimum, of acrylic epoxy.
c. Locations:
1) Food Preparation and Dining Areas such as:
a) Kitchen Areas.
b) Food Serving Areas.
c) Dishwashing Areas.
d) Food Storage Areas.
e) Kitchen Office Areas.
f) Kitchen Toilet and Locker Areas.
g) Dining Areas.
h) Cafeterias.
2) Toilets and Janitor Closets.
3) Locker Rooms.
d. Apply additional coats as required to achieve even surface finish acceptable to the local Health Department having jurisdiction.
e. All surfaces must be acceptable to Health Department officials and pass the “ketchup test” requirements.

C. Interior Concrete Floors Requiring Sealed Finish: This provision is only for concrete floors indicated to have Sealed Concrete Finish. It is not intended for Stained and Polished Concrete Floors that would be indicated in Section 03 35 43 - Polished Concrete Finishing.
1. One coat Liquid Densifier: Penetrating lithium silicate sealer, hardener, and densifier.

a. Prosoco - Consolideck LS Hardener/Densifier. (Basis of Design)
b. Convergent Concrete Technologies - Pentra-Sil (HD).
c. Ameripolish - Ameripolish 3D HS.
d. Substitutions: Section 01 60 00 - Product Requirements.

2. Two coats Protective Treatment: Penetrating lithium silicate protective treatment.
a. Prosoco - Consolideck PolishGuard Finish. (Basis of Design)
b. Convergent Concrete Technologies - Pentra-Finish (HG).
c. Ameripolish - Ameripolish SR2.
d. Substitutions: Section 01 60 00 - Product Requirements.

D. Interior Steel - Unprimed:
1. One coat of acrylic primer.
a. BM - Corotech Acrylic Metal Primer V110.
b. PPG - Pitt-Tech Plus 4020 PF DTM Acrylic Primer.
c. SW - Pro Industrial Pro-Cryl Universal Primer.
2. Two top coats of acrylic enamel finish.
a. BM - Corotech Acrylic DTM Enamel Semi-Gloss V331.
b. PPG - Pitt-Tech Plus EP DTM Acrylic Semi-Gloss.
c. SW - Pro Industrial Waterbased Alkyd Urethane Enamel Semi-Gloss.

E. Interior Steel - Primed:
1. One coat of acrylic primer.
a. BM - Corotech Acrylic Metal Primer V110.
b. PPG - Pitt-Tech Plus 4020 PF DTM Acrylic Primer.
c. SW - Pro Industrial Pro-Cryl Universal Primer.
2. Two top coats of acrylic enamel finish.
a. BM - Corotech Acrylic DTM Enamel Semi-Gloss V331.
b. PPG - Pitt-Tech Plus EP DTM Acrylic Semi-Gloss.
c. SW - Pro Industrial Waterbased Alkyd Urethane Enamel Semi-Gloss.

F. Interior Steel - Galvanized:
1. One coat acrylic primer.
a. BM - Ultra Spec HP Acrylic Metal Primer HP04.
b. PPG - Pitt-Tech Plus 4020 PF DTM Acrylic Primer.
c. SW - Pro Industrial Pro-Cryl Universal Primer.
2. Two top coats of acrylic enamel finish.
a. BM - Advance Waterborne Interior Alkyd Semi-Gloss.
b. PPG - Pitt-Tech Plus EP DTM Acrylic Semi-Gloss.
c. SW - Pro Industrial Waterbased Alkyd Urethane Enamel Semi-Gloss.

G. Interior Aluminum - Mill Finished:
1. One coat acrylic primer.
a. BM - Ultra Spec HP Acrylic Metal Primer HP04.
b. PPG - Pitt-Tech Plus 4020 PF DTM Acrylic Primer.
c. SW - Pro Industrial Pro-Cryl Universal Primer.
2. Two top coats of acrylic enamel finish.
a. BM - Advance Waterborne Interior Alkyd Semi-Gloss.
b. PPG - Pitt-Tech Plus EP DTM Acrylic Semi-Gloss.
c. SW - Pro Industrial Waterbased Alkyd Urethane Enamel Semi-Gloss.

H. Interior Gypsum Board - Walls:
1. One coat latex primer sealer.
a. BM - Ultra Spec 500 Interior Latex Primer.
b. PPG - Pure Performance Interior Acrylic Primer.
c. SW - ProMar 200 Zero VOC Interior Latex Primer.
2. Two top coats of latex finish.

a. BM - Ultra Spec 500 Interior Latex Finish Eggshell
b. PPG - Speedhide Zero VOC Interior Latex Eggshell.
c. SW - ProMar 200 Zero VOC Interior Latex Eg-Shel.

I. Interior Gypsum Board - Walls (Epoxy Coating):
1. One coat of epoxy primer sealer.
a. BM - INSL-X Aqua Lock Plus.
b. PPG - Pure Performance Interior Acrylic Primer.
c. SW - ProMar 200 Zero VOC Interior Latex Primer.
2. Two top coats of acrylic epoxy finish.
a. BM - Corotech Pre-Catalyzed Waterborne Epoxy Semi-Gloss.
b. PPG - Pitt-Glaze WB1 Interior Pre-Catalyzed Acrylic Epoxy Semi-Gloss.
c. SW - Pro Industrial Pre-Catalyzed Waterbased Epoxy Semi-Gloss.
3. Locations Include:
a. Food Preparation and Dining Areas such as:
1) Kitchen Areas.
2) Food Serving Areas.
3) Dishwashing Areas.
4) Food Storage Areas.
5) Kitchen Office Areas.
6) Kitchen Toilet and Locker Areas.
7) Dining Areas.
8) Cafeterias.
b. Toilets and Janitor Closets.
c. Locker Rooms.

J. Interior Gypsum Board - Ceilings and Bulkheads:
1. One coat latex primer sealer.
a. BM - Ultra Spec 500 Interior Latex Primer.
b. PPG - Pure Performance Interior Acrylic Primer.
c. SW - ProMar 200 Zero VOC Interior Latex Primer.
2. Two top coats of latex finish.
a. BM - Ultra Spec 500 Interior Latex Finish Flat.
b. PPG - Speedhide Zero VOC Interior Latex Flat.
c. SW - ProMar 200 Zero VOC Interior Latex Flat.

K. Interior Dry Fall (Dry Fog):
1. One coat of primer sealer.
a. Product recommended by top coat manufacturer for each substrate type.
2. Two top coats of acrylic finish.
a. BM - Coronado Super Kote 5000 Dry Fall Acrylic Latex Flat.
b. PPG - Speedhide Super Tech WB Interior Dry Fog Flat.
c. SW - Pro Industrial Waterborne Acrylic Dryfall Flat.

L. Interior Wood (Stain):
1. Stain:
a. BM - Product recommended by top coat manufacturer for substrate type.
b. PPG - DEFT Interior Oil Based Stain.
c. SW - Minwax Performance Series Tintable Interior Wood Stain.
2. Three top coats finish:
a. Refer to Wood - Transparent Top Coat on Stained below.

M. Interior Wood (Transparent Top Coat on Stained Wood and Non-Stained Wood):
1. One coat sealer.
a. Product recommended by top coat manufacturer for substrate type.
2. Three top coats of transparent acrylic coating.

a. BM - Lenmar Aqua-Plastic Acrylic Urethane Clear Semi-Gloss.
b. PPG - DEFT Interior Polyurethane Water Based Acrylic Semi-Gloss.
c. SW - Minwax Water-Based Oil-Modified Polyurethane Clear Semi-Gloss.

END OF SECTION

SECTION 10 14 00

SIGNAGE

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Room Identification Signs.
2. Applied Vinyl Graphics.
3. Custom Artwork Applied Vinyl Graphics.
4. Dimensional Letter Signs.
5. Notification Signs.
6. Fire Protection Signs.
7. Warning Stencils.
8. Dedication Plaque.

B. Related Requirements:
1. Section 01 40 00 - Quality Requirements: Mockup requirements indicated in Schedule of Mockups at end of Section 01 40 00.
2. Sections related to identification of Plumbing, HVAC, and Electrical work.
3. Sections related to Civil and Site work.

1.2 REFERENCES

A. American Iron and Steel Institute (AISI).

B. American National Standards Institute (ANSI):
1. ANSI Z97.1 - Safety Glazing Materials Used In Buildings - Safety Performance Specifications And Methods Of Test; 2015, Reaffirmed 2020.

C. Americans with Disabilities Act (ADA):
1. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; Current Edition.

D. ASTM International (ASTM):
1. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.
2. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
3. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2019.

E. Code of Federal Regulations (CFR):
1. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; Current Edition.

F. International Code Council (ICC):
1. ICC A117.1 - Accessible and Usable Building and Facilities; 2017.

G. Ingress Protection Code (IP Code):
1. IP Code - Degree of Protection Provided by Enclosures; ANSI/IEC 60529 2020.

H. UL Standards (UL):
1. UL 48 - Electric Signs; Edition 15, 2011, Revisions 2022.
2. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data describing the material, fabrication standards and characteristics of the sign systems indicated in the Section and other Contract Documents.

C. Shop Drawings: Indicate sign types, styles, lettering font, copy, graphics, features, foreground and background colors, locations, overall dimensions of each sign and attachment method.
   1. Indicate connection locations for signage requiring electrical or communication wiring.

D. Samples for Initial Selection: Two manufacturer's color charts illustrating the full range of finishes and colors available for each sign type; include color options for backgrounds, graphics, and copy; submit for Architect's initial selections.

E. Samples for Verification: From the Architect's initial selections, prepare and submit two samples for each selected finish and color; samples on same product material type indicated for final Work; each sample 6 x 8 inches illustrating sign type, sign features, graphics, and method of attachment. Where finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.

F. Manufacturer's Installation Instructions: Submit installation template and attachment devices.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum five (5) years documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Package signs, labeled in name groups.

C. Store adhesive attachment tape at ambient room temperatures.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.

B. Do not install signs when ambient temperature is lower than recommended by manufacturer.

C. Maintain this minimum temperature during and after installation of signs.

1.7 WARRANTY

A. Section 01 77 00 - Closeout Procedures: Product warranties.

B. LED Marquee Signs: Provide warranties indicated in the description of the LED Marquee Sign in this Section.

PART 2 PRODUCTS

2.1 PERFORMANCE AND DESIGN REQUIREMENTS

A. Conform to current local and state building codes; ADA Standards; 36 CFR 1191; and ICC A117.1 guidelines for manufacture and installation of interior identification signs.

B. Conform to current International Fire Code requirements.

2.2 MANUFACTURERS

A. Manufacturers:
1. Acorn Sign Graphics.
2. APCO Graphics.
3. ASI Sign Systems.
4. Avery Dennison.
5. Bayuk Graphic Systems, Inc.
6. Best Sign Systems.
7. Interface Architectural Signage, Inc.
8. InPro Corporation (Signscape).
9. Mohawk Sign Systems.
10. Rowmark, LLC.
11. Scott Sign Systems, Inc.
12. Signage Industries Corporation.
13. Substitutions: Section 01 60 00 - Product Requirements.

2.3 ROOM IDENTIFICATION SIGNS

A. Includes signs for rooms and area identification, fire extinguishers and fire extinguisher cabinets, unlighted exit signs, room capacity signs, areas of refuge, and elevators and stairs related signs as indicated on Drawings.
1. Photopolymer face fused to phenolic sheet; 0.145 inch total thickness; matte finish.
2. “Tactile" signage, with copy raised minimum 1/32 inch above sign surface using photopolymer bonded process and with Grade II Braille located below copy.
3. Clear Window Insertion Slots: As indicated on Drawings.
4. Copy and graphics to be uniformly opaque.
5. Copy Font: Helvetica Medium, uppercase.
6. Copy Height: As indicated on Drawings.
7. Braille Height: As indicated on Drawings.
8. Symbol Size: As indicated on Drawings.
9. Total Thickness: As indicated on Drawings, but not less than 0.145 inch.
10. Size and Configuration: As indicated on Drawings.
11. Corners: 1/2 inch radius unless indicated otherwise on Drawings.
12. Edges: Beveled and smooth.
13. Graphic Style: International type.
14. Colors:
    a. Background: As selected by Architect from submitted samples.
    b. Copy:
        1) As selected by Architect from submitted samples.
    c. Symbols and Graphics:
        1) As selected by Architect from submitted samples.
15. Room Identification Sign Types:
    a. Drawings indicate Sign Type Designations, Size, Copy, Symbols, and Insert Window requirements.
    b. Signs required at all door openings and spaces and as indicated on Drawings.
    c. Refer to Signage Schedule, Elevations, and Details on Drawings.
    d. Include twelve (12) additional identification signs with graphics to be determined during construction. Type to be the type with insert window.
    e. Back Cover Plate: Where sign must be secured to glass, acquire Architect approval prior to fabrication and installation of a Backing Cover (blank solid sign) on the opposite side of the glass. The backing cover material shall match

the size, shape, base color, thickness, and finish of the sign. The intent is to hide the unsightly back view of the sign when viewed on the opposite side of the glass. (Back Cover Plate, also referenced in ACCESSORIES, and INSTALLATION articles in this Section.)

2.4 APPLIED VINYL GRAPHICS

A. Vinyl film, die-cut characters; 2 inches high, 3 mils thick.
   1. Adhesive backing to be pressure-sensitive and exterior application grade type.

B. Provide door graphics for each of the following:
   1. Copy: **VISITORS REPORT TO MAIN OFFICE** (10 signs required)
   2. Copy: **TOBACCO FREE PROPERTY** (10 signs required)
   3. Copy: **DELIVERIES ONLY** (2 signs required)

2.5 CUSTOM ARTWORK APPLIED VINYL GRAPHICS

A. Permanent Applied Custom Vinyl Graphics:
   1. Manufacturers:
      a. Avery Dennison.
      b. Substitutions: Section 01 60 00 - Product Requirements.
   2. Smooth Substrate Applications: Graphics to be applied to smooth substrates including Level 5 finished and painted gypsum board or plaster.
      a. Basis of Design: Avery Dennison MPI 1405 with DOL 6460.
   3. Textured Substrate Applications: Graphics to be applied to textured substrates including concrete, brick masonry units, and concrete masonry units.
      a. Basis of Design: Avery Dennison MPI 1105 with DOL 1300z.
   4. Substrate Finish: Finish and paint requirements are to be completed and fully cured/dry prior to application of graphics.
      a. Paint cure/dry time for smooth substrates to be not less than five (5) days or as required for full cure.
   5. Graphic Designs: Design is to include custom imagery and colors.
      a. Designs to be provided by Architect.
         1) Each graphics application to be of different and unique design.
   6. Locations: As indicated on Drawings.

2.6 DIMENSIONAL LETTER SIGNS

A. Exterior Metal Letters: Architectural grade aluminum.
   1. Thickness:
      a. 1 inch.
   2. Height:
      a. Refer to Copy and Locations in following paragraphs.
   3. Copy Style: Helvetica Medium, unless indicated otherwise on Drawings.
   4. Finish: Brushed. Unless noted otherwise.
   5. Copy and Locations: Characters to be designated by Architect.

      a. Building Face - Address Identification (as required by building codes):
         1) Copy text, height, and location on building exterior to be as required and designated by the local Fire Marshal and IBC 501.2 code.
         2) 12 inches high minimum.
      b. Building Face - Building Name.
         1) Mounted on masonry building wall; height and location to be as follows:

            a) As indicated on Drawings.

2) PAMLICO COUNTY HIGH SCHOOL, 12 inches high.

c. Building Face - Building Name.

1) Mounted on metal panel building wall; height and location to be as follows:

:

a) As indicated on Drawings.

2) PAMLICO COUNTY HIGH SCHOOL, 24 inches high.

d. Building Face – Emergency Door Numbers

a) As indicated by architect.

2) 1,2,3,4,5,6,7, 16 inches high (7 total characters)

3) Finish to be selected from the full range of standard powder coated options. To be high contract characters from building face location.

B. Interior Metal Letters: Architectural grade aluminum.

1. Thickness:
   a. As indicated on drawings
2. Height:
   a. As indicated on Drawings.
3. Mounting:
   a. Stand-offs : 1" Standoffs where indicated, concealed fasteners.
   b. Surface Mounted: Mount with concealed stud, adhered with construction adhesive.
4. Copy Style: Helvetica Medium, unless indicated otherwise on Drawings.
5. Finish:
   a. Painted: As indicated on drawings
   b. Wood: From manufactures full range – As indicated on drawings.
6. Copy:

   a. Copy: **WRESTLING** (1 signs required)
   b. Copy: **WEIGHT ROOM** (1 signs required)
   c. Copy: **PAMLICO COUNTY HIGH SCHOOL** (1 signs required)
   d. Copy: **GIRLS** (5 signs required)
   e. Copy: **BOYS** (5signs required)
   f. Copy: **BOY'S LOCKER ROOM** (1 signs required)
   g. Copy: **GIRL'S LOCKER ROOM** (1 signs required)

C. Interior Wood Letters: Solid Wood.

1. Thickness:
   a. As indicated on drawings
2. Height:
   a. As indicated on Drawings.
3. Mounting:
   a. Stand-offs : 1" Standoffs where indicated, concealed fasteners.
   b. Surface Mounted: Mount with concealed stud, adhered with construction adhesive.

4. Copy Style: Helvetica Medium, unless indicated otherwise on Drawings.
5. Finish:
   a. Wood: Red Oak – Seal to match wood doors.
6. Copy:
   a. Copy: **HURRICANE GRILL**(1 signs required)
   b. Copy: **CONCESSIONS** (1 signs required)
   c. Copy: **HIGH SCHOOL** (1 signs required)
   d. Copy: **MIDDLE SCHOOL** (1 signs required)

e. Copy: **ADMINISTRATION** (1 signs required)
f. Copy: **ATHLETICS** (1 signs required)
g. Copy: **GUIDANCE** (1 signs required)
h. Copy: **PAMLICO COUNTY HIGH SCHOOL** (1 signs required)

2.7 NOTIFICATION SIGNS

A. Material: Plastic with radius corners.
1. Size: 1/8 inch thick; H x W to be as required for Copy.
2. Color: White background.
3. Letters: 2 inch high black letters.
4. Copy: **DELIVERIES ONLY** (1 sign required)

2.8 FIRE PROTECTIONS SIGNS

A. Engineering Grade (Type I) Reflective Aluminum: Red reflective lettering on white background, unless indicated otherwise on Drawings.

B. Comply with requirements of International Fire Code requirements.

C. Size: As indicated on Drawings.

D. Characters: Style and copy as required by NCBC 2018 standards.

E. Sign Types: Sign and Copy sizes vary; refer to Drawings.
1. Fire Department Connection Sign with directional arrows as required. (2 signs required)
a. Copy: **FDC**
2. Fire Sprinkler Riser Room Sign. (2 signs required)
a. Copy: **FIRE SPRINKLER RISER ROOM**
3. Fire Alarm Control Panel Sign. (2 signs required).
a. Copy: **FACP**
4. Fire Hose Valve Connection Sign. (4 signs required; locations and final copy to be determined).

2.9 Copy: FIRE HOSE VALVE CONNECTIONWARNING STENCILS

A. Reusable stencils for painting warning on both sides of rated walls, above hung ceiling.
1. Copy: **X-HOUR RATED WALL - PROTECT ALL OPENINGS** (X is to be the actual numeral that represents the wall fire rated time designation.
2. Letter Color: Red.
3. Letter Size: 3 inches tall.
4. Spacing: Apply at 15 feet o.c. at all rated walls above ceilings on both sides of walls.
5. Quantity: Since stencils are reusable, quantity is determined by Contractor.

2.10 DEDICATION PLAQUE

A. Dedication Plaque:
1. Material: Cast bronze.
2. Quantity: One.
3. Size:
a. 18 x 24 inches.
4. Border:
a. Single line type.
5. Finish: Pebble texture, oxidized finish.
6. Letter Finish: Satin polish.

7. Mounting: Standard concealed mounting to comply with the manufacturer's written instructions for type of wall surface indicated.
8. Characters: Style and copy to be selected by Architect and Owner from manufacturer's full range of options.
    a. Plaque to include the following information:
        1) Project Name. To be determined by Architect and Owner.
        2) Date of Construction.
        3) School System Information:
            a) Names and Title of all the Board of Education Members.
            b) Name and Title of the School System Superintendent.
        4) Names and Titles of Persons to be determined by Owner. Allow for twenty (20) names and titles. Person groups may require headings such as board member groups or commission member groups or director member groups.
        5) Architect's Name and Location.
        6) Construction Manager's Name.
        7) General Contractor's Name.

2.11 ACCESSORIES

A. Concealed Stud: Length based on letter thickness, stud boss and spacer sleeve, ½ inch standoff. Locations as required by manufacture.

B. Mounting Hardware: Screws; stainless steel; countersunk phillips flat head screws.

C. Tape Adhesive: Double sided foam tape; permanent adhesive.

D. Back Cover Plate: Where sign must be secured to glass, acquire Architect approval prior to fabrication and installation of a Backing Cover (blank solid sign) on the opposite side of the glass. The backing cover material shall match the size, shape, base color, thickness, and finish of the sign. The intent is to hide the unsightly back view of the sign when viewed on the opposite side of the glass. (Back Cover Plate, also referenced in ROOM IDENTIFICATION SIGNS and INSTALLATION articles in this Section.)

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 73 00 - Execution: Verification of existing conditions before starting work.

B. Verify substrate if finished to include finish coating(s).

C. Verify adequate blocking and supports to structure are installed and ready to receive work.

D. Verify that electrical and communications wiring requirements are provided for connectivity.

3.2 PREPARATION

A. Section 01 73 00 - Execution: Prepare field conditions and existing construction for installation of work of this section.

B. Prepare materials to be installed and equipment to be used during installation.

3.3 INSTALLATION

A. Section 01 73 00 - Execution: Related to installation of Work.

B. Install work at locations indicated on Drawings. Install signs level and plumb unless indicated otherwise.

C. Room Identification Signs: Mount with double sided foam tape and countersunk phillips flat head screws. Screw head is to finish flush with sign surface. Finish of screw heads is to match the color and finish of the portion of the sign that the screw is seated into.
   1. Position of Room Identification Signs:
      a. Signage mounting heights must conform to ADA accessibility requirements including the height of Braille notations. Mount center of sign 9 inches from strike side of door and top of sign at 60 inches from floor.
   2. Where sign must be secured to glass, acquire Architect approval prior to fabrication and installation of a Backing Cover (blank solid sign) on the opposite side of the glass. The backing cover material shall match the size, shape, base color, thickness, and finish of the sign. The intent is to hide the unsightly back view of the sign when viewed on the opposite side of the glass. (Back Cover Plate, also referenced in ROOM IDENTIFICATION SIGNS and ACCESSORIES articles in this Section.)

D. Applied Vinyl Graphics: Mount on exterior of glass doors.

E. Custom Artwork Applied Vinyl Graphics: Prepare substrate for vinyl graphics application.
   1. Substrate is to be free from all contaminants that interfere with adhesion of preparation coatings and application of vinyl graphics.
   2. Substrate surface is to be finished to smoothness and characteristics as recommended by vinyl graphics manufacturer and as follows:
      a. Gypsum Wallboard: To be finished to Level 5 finish.
      b. Concrete Masonry Units: As recommended by vinyl graphics manufacturer.
   3. Paint Coatings: Surface of application area is to be painted prior to vinyl application.
      a. Do not use Low VOC type paint.
      b. Paint topcoat is to have semi-gloss sheen.
      c. Paint primers and topcoats are to have been applied and cured for the follow duration prior to application of vinyl graphics:
         1) Gypsum Wallboard: Five (5) days minimum.
         2) Concrete Masonry Units (CMU): Seven (7) days minimum.

F. Dimensional Letter Signs: Mount with stainless steel threaded rods into expansion shields. All hardware shall be stainless steel.

G. Mount fire protection system signage in accordance with International Fire Code requirements.

H. Dedication Plaque: Mount with stainless steel threaded rods into expansion shields.

I. LED Marquee Sign: Construct and install sign system, including programming software and hardware, in compliance with the engineer's design, manufacturer's recommendations and the Drawings.

3.4 CLEANING

A. Section 01 73 00 - Execution and Section 01 77 00 - Closeout Procedures: Clean installed work and comply with manufacturer’s recommendations.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 73 00 - Execution: Protecting installed construction.

3.6 DEMONSTRATION AND TRAINING

A. Section 01 79 00 - Demonstration and Training: Provide demonstration and training to the Owner regarding operation and maintenance of components of the installed Work.

END OF SECTION

SECTION 10 21 13.19

PLASTIC TOILET COMPARTMENTS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes solid plastic toilet compartments and urinal screens.

B. Related Requirements:
   1. Section 10 28 13 - Toilet Accessories.

1.2 REFERENCES

A. ASTM International (ASTM):
   1. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2023.
   2. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023a.

B. International Code Council (ICC).

C. National Fire Protection Association (NFPA):
   1. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2019.

1.3 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate Work with placement of support framing and anchors in wall.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data on panel construction, hardware, and accessories.

C. Shop Drawings: Indicate partition plans, door swings, elevation views, dimensions, details of wall and floor supports.

D. Samples for Initial Selection: Two manufacturer's complete sets of color samples illustrating the full range of finishes and colors available. Submit for Architect’s initial selections.

E. Samples for Verification: From the Architect’s initial selections, prepare and submit two samples for each selected finish and color; samples to be same product material type indicated for final Work; each sample 4 x 4 inches. Where finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.

F. Manufacturer’s Installation Instructions: Include special procedures and perimeter conditions requiring special attention.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS:

A. Fire Resistance: Partition materials shall comply with the following requirements, when tested in accordance with ASTM E84:

1. Class A: 25 maximum flame spread index; 450 maximum smoke developed index.

B. Material Fire Ratings:
1. NFPA 286: Pass.
2. International Code Council (ICC): Class B.

2.2 SOLID PLASTIC TOILET COMPARTMENTS

A. Manufacturers:
1. All American Metal Corp - AAMCO.
2. ASI Global Partitions.
3. Metpar Corporation.
4. Partition Systems International of South Carolina (PSiSC).
5. Scranton Products.
6. Substitutions: Section 01 60 00 - Product Requirements.

B. Basis of Design:

2.3 ASI Global PartitionsCOMPONENTS

A. Toilet Compartments: Solid, molded thermoset, and waterproof; high-density polyethylene (HDPE) plastic panels, doors, and pilasters. Dimensions to be as indicated unless indicated otherwise on Drawings.
1. Panels:
a. Thickness: 1 inch.
b. Width: As indicated on Drawings.
c. Height:
1) As indicated on Drawings.
2. Doors:
a. Thickness: 1 inch.
b. Width:
1) Accessible (H/C) Compartment Doors: Out-swinging with opening clearance of 32 inches (with no obstructions). Coordinate with door thickness and hardware to ensure there are no obstructions within the required 32 inches clear opening.
2) Standard Compartment Doors: 28 inches.
c. Height:
1) Match compartment panels.
3. Urinal Screens:
a. Thickness: 1 inch.
b. Width: Total projection from wall to be 23 inches. Dimension includes pilaster assembly where pilaster is indicated on Drawings.
c. Height:
1) As indicated on Drawings.
4. Pilasters:
a. Thickness: 1 inch.
b. Widths: As required to fit space and not less than 3 inches.
c. Height:
1) As indicated on Drawings.
5. Color:
a. As selected by Architect from manufacturer's full range.

2.4 ACCESSORIES

A. All finish metal components and accessories to be as follows, unless otherwise indicated:
1. Satin Finish.

B. Pilaster Shoe: Formed ASTM A666 Type 304 stainless steel, 3 inches high, concealing floor mounting and adjustment hardware. Provide adjustment for floor variations with screw jack through steel saddles integral with pilaster. All metal mounting and adjustment hardware to be stainless steel.

C. Head Rails: Extruded aluminum tube, color clear anodized 1 x 1-5/8 inch size, with anti-grip profiles and cast socket wall brackets. Maximum lengths practical. Head Rails to extend to wall and be anchored securely to wall frame blocking.

D. Vertical Brackets: Double flange type.
1. Extruded aluminum; color clear anodized.
   a. Continuous length.

E. Attachments, Screws, and Bolts: Stainless steel, tamper proof type.
1. Attaching panels and pilasters to brackets: Binding Post through-bolts and nuts.
2. Attaching hardware: Binding Post through-bolts and nuts; tamper proof.

F. Hardware:
1. Material:
   a. Stainless steel.
2. Hinges:
   a. Continuous hinges, self-closing.
3. Door Latch: Slide type with exterior emergency access feature.
4. Door Strike and Keeper: Include rubber bumper; mounted on pilaster in alignment with door latch.
5. Door Stop: Provide door stop for each door, mounted on door face to prevent door assembly from hitting wall or other finishes. Door stop design to be coat hook type, rubber tip, four (4) screw mounting base, and finish to match other door hardware.
   a. Basis of Design: Bobrick B-212.
6. Provide door pull on each side of door for out-swinging doors.
7. Provide metal heat sink at bottom of doors and partitions.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 73 00 - Execution: Verification of existing conditions before starting work.

B. Verify field measurements are as indicated on shop drawings.

C. Verify correct spacing of and between plumbing fixtures.

D. Verify correct location and adequate support of built-in framing, anchorage, and bracing.

3.2 INSTALLATION

A. Section 01 73 00 - Execution: Related to installation of Work.

B. Install work level and plumb.

C. Attach panel brackets securely to support framing and anchor points using anchor devices.

D. Attach panels and pilasters to brackets.

E. Locate head rail joints at pilaster center lines.

F. Adjust pilaster shoe leveling screws to produce level and plumb panel construction on sloped floors.

3.3 ERECTION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation from Indicated Position: 1/4 inch.

C. Maximum Variation from Plumb: 1/8 inch.

3.4 ADJUSTING

A. Section 01 73 00 - Execution: Adjusting.

B. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.

C. Adjust hinges to position in-swinging doors in partial open position (about 3 inches open) when unlatched. Return out-swinging doors to closed position.

D. Adjust adjacent components for consistency of line or plane.

3.5 CLEANING

A. Section 01 73 00 - Execution and Section 01 77 00 - Closeout Procedures: Clean installed work and comply with manufacturer's recommendations.

B. Clean installed work in accordance with manufacturer's recommended materials and procedures.

3.6 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 73 00 - Execution: Protecting installed construction.

END OF SECTION

SECTION 10 26 23.14
WALL PROTECTION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Wall Corner Guards.

1.2 REFERENCE STANDARDS

A. ASTM International (ASTM):
   1. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics; 2023, Editorial Revision 2023.
   2. ASTM D543 - Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents; 2021.
   3. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023a.
   4. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, Editorial Revision 2021.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

B. Coordinate installation of appropriate strength concealed blocking with the anchoring requirements for attaching the work of this Section to substrate.

C. Coordinate installation of wall coating and wall cover finishes to be complete prior to installation of the work of this Section.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data on unit construction, sizes, configuration, jointing methods and locations when applicable, and attachment method.

C. Shop Drawings: Submit shop drawings including profiles, elevations, locations, attachment to substrate, and accessories.

D. Samples for Initial Selection: Two manufacturer's color charts illustrating the full range of finishes and colors available for products with factory-applied color finishes; submit for Architect’s initial selections.

E. Samples for Verification: From the Architect’s initial selections, prepare and submit two samples for each selected finish and color; samples on same product material type indicated for final Work; each sample 4 x 4 inches. Where finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.

F. Manufacturer’s Installation Instructions: Indicate special installation criteria and interface with adjacent components.

1.5 QUALITY ASSURANCE

A. Provide protection systems of each type from a single source and manufacturer.

1.6 QUALIFICATIONS

A. Manufacturer Qualifications: Company specializing in manufacturing Products specified in this Section with minimum seven (7) years documented experience.

B. Installer Qualifications: Company specializing in performing work of this Section and with minimum five (5) years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Deliver products in manufacturer's original packaging. Store materials in a dry, protected, well-vented area. Inspect product upon receipt and report damaged material immediately to delivering carrier and note such damage on the carrier's freight bill of lading.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with the following unless otherwise indicated:
1. Impact Strength: Applicable provisions of ASTM D256.
2. Lateral Impact: Resists lateral impact force of 100 lbs (445 N) at any point without damage or permanent set.
3. 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.
4. Chemical and Stain Resistance: Applicable provisions of ASTM D543.
5. Fungal Resistance: Passes ASTM G21 testing.

2.2 WALL CORNER GUARDS

A. Metal Wall Corner Guards:
1. Manufacturers:
   a. Construction Specialties, Inc.
   b. Inpro.
   c. Wallprotex.
   d. Western Fabricating, LLC.
   e. Substitutions: Section 01 60 00 - Product Requirements.
2. Corner Guard Material: Stainless Steel
3. Thickness:
   a. 16 gauge.
4. Edges: Factory formed edges to fit snug to wall surface.
5. Attachment:
   a. Fasteners: Stainless steel of length required to anchor corner guard.
      1) Screw heads to be flat head, Phillips drive style.
   b. Factory pre-drill and countersink holes in corner guard wings at 1 inch from edges and vertically at 12 inches o.c. Countersink is to match back taper and diameter of screw head.
6. Lengths: One piece.
   a. As indicated on Drawings.
7. Width of Wings:
   a. 2 inches.
8. Corners:
   a. 1/8 inch radius.

9. Finish:
   a. No. 4, stainless steel.
10. Protective Film: Factory apply removable film to protect finish during handling.
11. Application Locations:
   a. As indicated on Drawings.

B. Extension Ladder Receiver
1. Manufacturer:
   a. BOD – LadderDock
2. Material:
   a. Galvanized Steel
3. Finish:
   a. Painted to match wall below. See Section 9 90 00 – Paintings and Coatings for application.
4. Length:
   a. Manufacture's standard
5. Attachment
   a. Attachment per manufacturer's recommendation, Contractor to provide required blocking.
6. Location:
   a. As indicated on plans.

2.3 ACCESSORIES

A. Accessories are to be appropriate to component, substrate and as indicated in this Section.
1. Mounting Brackets and Attachment Hardware: As recommended by manufacturer.

2.4 FABRICATION

A. Fabricate components free of visual distortion and free of defects.

B. Fabricate components with tight joints, corners, and seams.

C. Pre-drill holes for attachment.

D. End closures are to be factory fabricated to match components.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 73 00 - Execution: Verification of existing conditions before starting work.

B. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.

C. Verify that field measurements are as required.

D. Verify that surfaces and conditions are ready to accept the Work of this Section.

E. Examine products to be installed for damage and other conditions detrimental to completion of the Work.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Section 01 73 00 - Execution: Prepare field conditions and existing construction for installation of Work of this Section.

B. Prepare materials to be installed and equipment to be used during installation.

3.3 INSTALLATION

A. Section 01 73 00 - Execution: Related to installation of Work.

B. Install the Work in compliance with the design requirements, applicable codes, manufacturer's recommendations, and the Contract Documents.

C. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to supporting construction.

D. Position bottom of corner guards 4 inches above finished floor unless indicated otherwise.

3.4 TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation From Required Height: 1/4 inch (6 mm).

3.5 CLEANING

A. Section 01 73 00 - Execution and Section 01 77 00 - Closeout Procedures.

B. Clean installed Work in accordance with manufacturer’s recommendations including cleaning procedures and materials.

3.6 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 73 00 - Execution: Protecting installed construction.

B. Protect installed construction from damage and unauthorized tampering.

END OF SECTION

SECTION 10 28 00

TOILET ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Toilet room accessories.
2. Shower accessories.
3. Utility room accessories.

B. Related Requirements:
1. Section 04 20 00 - Unit Masonry.
2. Section 06 10 53 - Miscellaneous Rough Carpentry: Blocking in framed walls.
3. Division 09 - Finishes: Sections describing wall materials and finishes.
4. Division 10 - Specialties: Sections describing Toilet Compartments.
5. Division 26 - Electrical: Construction related to electric devices.

1.2 REFERENCES

A. Americans with Disabilities Act (ADA):
1. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; current edition.

B. ASTM International (ASTM):
1. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
2. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service, 2022.
3. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
4. ASTM A666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar, 2023.
5. ASTM B86 - Standard Specification for Zinc and Zinc-Aluminum (ZA) Alloy Foundry and Die Castings; 2022.
6. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium; 2017, Reapproval 2022.
7. ASTM C1036 - Standard Specification for Flat Glass; 2021.
8. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.
9. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2018.
10. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs; 2022.

1.3 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate the Work with placement of internal wall reinforcement and reinforcement of toilet partitions to receive anchor attachments.

C. Coordinate electrical requirements with electrical service construction.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data on accessories describing size, finish, details of function, attachment methods.

C. Manufacturer's Installation Instructions: Submit special procedures, conditions requiring special attention.

1.5 QUALITY ASSURANCE

A. Single Source Responsibility: Provide products of same manufacturer for each type of accessory unit and for units exposed to view in same areas, unless otherwise acceptable to Architect (Exception: Electric hand dryers.).

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. All devices to be compliant with applicable codes and ADA standards.

B. Manufactured and 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.

C. Design grab bars, attachments, anchors and provide blocking to resist minimum 250 lbs concentrated load applied at any point in any direction.

D. Keys: Furnish two (2) keys for each accessory to Owner; master key lockable accessories.

2.2 TOILET AND BATH ACCESSORIES

A. Manufacturers:
   1. American Specialties, Inc. (ASI).
   2. Bobrick Washroom Accessories.
   3. Bradley Corporation.
   4. Electric Hand Dryers:
      a. Bobrick Washroom Accessories.
      b. Dyson.
      c. Excel Dryer, Inc.
      d. Pinnacle Dryer Corporation.
   5. Substitutions: Section 01 60 00 - Product Requirements.

2.3 MATERIALS

A. Stainless Steel Sheet: ASTM A666, Type 304.

B. Stainless Steel Tubing: ASTM A269/A269M, Grade T316.

C. Galvanized Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.

D. Zinc Alloy: Die cast, ASTM B86.

E. Mirror Glass:
   1. Fully tempered safety glass, ASTM C1048; and ASTM C1036 Type I, Class 1, Quality Q2, with silvering as required.

F. Adhesive: Two component epoxy type, waterproof.

G. Fasteners, Screws, and Bolts: Stainless steel, ASTM F593; tamper-proof, security type.

H. Expansion Shields: Fiber, lead, stainless steel, or rubber as recommended by accessory manufacturer for component and substrate.

2.4 TOILET ROOM ACCESSORIES

A. Toilet Tissue Dispenser (TD): Box type with only one roll accessible at a time.
1. Furnished by Owner. Installed by Contractor.

B. Paper Towel Dispenser (PTD):
1. Furnished by Owner. Installed by Contractor.

C. Waste Receptacle (WR):
1. Furnished and installed by Owner.

D. Soap Dispenser (SD):
1. Furnished by Owner. Installed by Contractor.

E. Framed Mirrors (MIR):
1. Mirror Glass: 1/4 inch thick tempered mirror glass; ASTM C1048, abrasion-resistant coated mirror.
2. Frame: Stainless steel; 3/4 inch angle shapes (0.05 inch thick); mitered and welded and ground corners; satin finish; tamperproof hanging system.
3. Backing: Full-mirror sized, minimum 0.03 inch galvanized steel sheet and non-absorptive filler material.
4. Size and Configuration: As indicated on Drawings.
5. Basis of Design:
a. Bradley 780 Series.

F. Grab Bars (GB):
1. Stainless steel, 1-1/2 or 1-1/4 inch outside diameter, minimum 0.05 inch (18 gauge) wall thickness, safety grip peened grasping surface finish; concealed flange mounting; 1-1/2 inches clearance between wall and inside of grab bar.
2. Push/Pull Point Load: 250 pound-force (1112 N), minimum.
3. Length and Configuration: As indicated on Drawings.
4. Basis of Design:
a. Bradley 812 Series (1-1/2 O.D.).

G. Sanitary Napkin Disposal Unit (SND):
1. Stainless steel; self-closing door; locking bottom panel with full-length stainless steel piano-type hinge and removable receptacle.
2. For thru-partition, 2 side access units, coordinate fit with toilet partition thickness.
3. Basis of Design:
a. Bradley 4722-15 (surface mounted).
b. Bradley 4731-15 (recess mounted).
c. Bradley 4721-15 (thru-partition, 2 sides).
d. Bradley 4722-1015 (semi recess mount).

H. Electric Hand Dryers (EHD): Coordinate electrical requirements.
1. Operation: Automatic sensor-operated on and off.
2. Air Nozzle: Fixed downward direction.
3. Basis of Design:
a. ADA Compliant - Surface Mount:
1) Pinnacle P3-12S - Stainless steel case; Heated air.

I. Baby Changing Table (BCT):

1. Basis of Design:
   a. Bradley 963 Series: Plastic; color as selected by Architect (surface mounted).

J. Coat Hook (CH): Solid aluminum casting, matte finish; rubber bumper protects wall and partition surfaces; 4 screws attachment base.
1. Provide coat hook on each toilet compartment door, inside compartment.
   a. Secure coat hooks with machine screws from hook side and pan head sleeve nuts (hex socket) from opposite end for thru-bolt assembly.
2. Provide coat hooks in locations indicated on Drawings.
3. Basis of Design:
   a. Bobrick B-212.

K. Wall Guard (WG):
1. Stainless steel, #4 Satin Finish; 15.8”x 31.8”
2. Coordinate with all hand dryer locations.
3. Basis of Design:
   a. Alpine Industries : 400-WALLG-MK (surface mounted).
4.

2.5 SHOWER ACCESSORIES

A. Grab Bars (GB):
1. Stainless steel, 1-1/2 or 1-1/4 inch outside diameter, minimum 0.05 inch (18 gauge) wall thickness, safety grip peened grasping surface finish; concealed flange mounting; 1-1/2 inches clearance between wall and inside of grab bar.
2. Push/Pull Point Load: 250 pound-force (1112 N), minimum.
3. Length and Configuration: As indicated on Drawings.
4. Basis of Design:
   a. Bradley 812 Series (1-1/2 O.D.) (Shower).

B. Shower Curtain Rod (SCR): Stainless steel tube, extra heavy duty; 1-1/4 inch outside diameter, 0.05 inch (18 gauge) wall thickness, satin-finished, with satin-finished stainless steel flanges, for concealed mounting.
1. Include shower curtain for each rod; opaque vinyl, 0.008 inch thick minimum, matte finish, with antibacterial treatment; flameproof and stain-resistant; 6 inches wider than rod length.
2. Include shower curtain hooks with each shower rod and curtain; stainless steel Type 304 wire, pear-shaped; sized to fit curtain rod diameter.
3. Basis of Design:
   a. Bradley 9539 (curtain rod).
   b. Bradley 9533 (curtain).
   c. Bradley 9536 (curtain hooks).

C. Robe Hook (RH): Stainless steel; single prong; rectangular-shaped hook; satin finish; concealed mounting with vandal resistant escutcheon.
1. Provide one (1) per each shower; locate outside stall on wall 16 inches from stall.
2. Basis of Design:
   a. Bradley 9114.

D. Shower Seat (SS): Folding type; surface wall-mounted; welded tubular seat frame, structural support members, hinges and mechanical fasteners of Type 304 stainless steel, rectangular seat; supports 500 lbs, minimum.
1. Seat: Phenolic or polymeric composite one-piece seat or seat slats, of color as selected by Architect.
2. Basis of Design:
   a. Bradley 9562.

2.6 UTILITY ROOM ACCESSORIES

A. Mop and Broom Holder (MH): 0.05 inch thick (18 gage), Type 304 stainless steel.
   1. Mop Holders: Four (4) spring-loaded rubber cam holders, holds mops 8 inches from wall.
   2. Shelf: 18 gage, 8 inches deep.
   3. Rag Hooks: One each, midway between mop holders.
   4. Length: 36 inches.
   5. Basis of Design:
      a. Bobrick B-224 x 36.

B. Mop Sink Wall Splash Guard: 16 gage, Type 304 Stainless steel.
   1. Provide wall guard at each mop sink in project.
   2. Wall guard height to span from mop sink top rim to 8 inches above water supply pipe wall penetrations, and not less than 36 inches above mop sink top rim.
   3. Fabrication: Custom fit to wall configuration; one piece fabrication; configured to protect all wall surfaces adjacent to mop sink rim; all edges to be single hemmed; corners to be ground smooth.
   4. Fasteners: Stainless steel, low profile pan head screws with EPDM bonded seal washer.
   5. Installation: Ensure that mop sink rim has been fully sealed to wall prior to installation of wall guard. At frame walls, ensure that adequate blocking is behind wall finish to engage with fasteners. Bottom of wall guard to be 1/8 inch above mop sink rim (allowing gap for application of sealant bead). After attaching wall guard to wall, apply sealant around entire perimeter of wall guard.

2.7 FACTORY FINISHING

A. Stainless Steel: No. 4 satin brushed finish, unless otherwise noted.

B. Chrome/Nickel Plating: ASTM B456, Type SC 2 polished finish, unless otherwise noted.

C. Baked Enamel: Pretreat to clean condition, apply one coat primer and minimum two coats epoxy baked enamel.

D. Powder-Coated Steel: Clean, degrease, and neutralize. Follow immediately with a phosphatizing treatment, prime coat, and two finish coats of powder coat enamel.

E. Galvanizing for Items Other than Sheet: Comply with ASTM A123/A123M; galvanized ferrous metal and fastening devices; minimum 1.2 oz/sq ft coating thickness; galvanized after fabrication.

F. Shop Primed Ferrous Metals: Pretreat and clean, spray apply one coat primer and bake.

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

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 73 00 - Execution: Verification of existing conditions before starting work.

B. Verify exact location of accessories for installation.

C. Verify that internal wall reinforcement and reinforcement of toilet partitions, to receive anchor attachments, is installed and adequate to attach the work securely.

D. Coordinate electrical requirements with electrical service construction.

E. Verify field measurements are as indicated on product data instructed by manufacturer.

3.2 PREPARATION

A. Section 01 73 00 - Execution: Prepare field conditions and existing construction for installation of work of this section.

B. Prepare materials to be installed and equipment used during installation.

C. Deliver inserts and rough-in frames to site for timely installation.

D. Provide templates and rough-in measurements as required.

3.3 INSTALLATION

A. Section 01 73 00 - Execution: Related to installation of Work.

B. Install plumb and level, securely and rigidly anchored to substrate.

C. Mounting Heights and Locations: As required by accessibility regulations and as indicated on Drawings.

3.4 ADJUSTING

A. Section 01 73 00 - Execution: Starting, testing, adjusting, and balancing.

B. Adjust and test installed Work for proper functionality.

3.5 CLEANING

A. Section 01 73 00 - Execution and Section 01 77 00 - Closeout Procedures: Related to cleaning.

B. Clean installed Work and comply with manufacturer's recommendations.

3.6 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 73 00 - Execution: Protecting installed construction.

B. Protect installed Work from damage.

END OF SECTION

SECTION 10 44 00

FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fire extinguishers.
   2. Fire extinguisher cabinets.
   3. Accessories.

B. Related Requirements:
   1. Section 04 20 00 - Unit Masonry: Walls for mounting equipment.
   2. Section 09 21 16 - Gypsum Board Assemblies: Walls for mounting equipment.

1.2 REFERENCE STANDARDS

A. ASTM International (ASTM):
   1. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2023a.

B. Factory Mutual (FM):
   1. FM (AG) - FM Approval Guide; Current Edition.

C. National Fire Protection Association (NFPA):
   1. NFPA 10 - Standard for Portable Fire Extinguishers; 2022.

D. Underwriters Laboratories Inc. (UL):
   1. UL (DIR) - Online Certification Directory; Current Edition.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data:
   1. Submit extinguisher operational features, full range of colors and finishes, and anchorage details.
   2. Submit cabinet product data, operational features, full range of colors and finishes, and anchorage details.

C. Shop Drawings:
   1. Indicate mounting measurements for brackets, locations, and fire ratings.
   2. Indicate cabinet physical dimensions, rough-in measurements for recessed cabinets, installation measurements for cabinets. Locations, and fire ratings.

D. Manufacturer's Installation Instructions: Submit special criteria and wall opening coordination requirements.

E. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 78 23 - Operation and Maintenance Data.

B. Operation and Maintenance Data: Submit test, refill or recharge schedules and recertification requirements.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.

B. Do not install extinguishers when ambient temperature is capable of freezing extinguisher ingredients.

PART 2 PRODUCTS

2.1 FIRE EXTINGUISHERS

A. Manufacturers:
1. Activar Construction Products Group Inc. - JL Industries.
2. Ansul, a Tyco Business.
3. Kidde, a unit of United Technologies Corporation.
4. Nystrom, Inc.
5. Potter-Roemer.
6. Pyro-Chem, a Tyco Business.
7. Substitutions: Section 01 60 00 - Product Requirements.

B. Basis of Design: Activar Construction Products Group Inc. - JL Industries.

C. 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.

D. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
1. Class: A:B:C type.
2. Size: 10 pounds.
3. Finish: Baked polyester powder coat, red color.
4. Temperature range: Minus 40 degrees F to 120 degrees F.

E. Wet Chemical Type Fire Extinguishers: Stainless steel tank, with pressure gauge.
1. Class: K type.
2. Size: 1.8 gallons.
3. Finish: Polished stainless steel.
4. Temperature range: Minus 20 degrees F to 120 degrees F.

2.2 FIRE EXTINGUISHER CABINETS

A. Manufacturers:
1. Activar Construction Products Group, Inc. - JL Industries.
2. Kidde, a unit of United Technologies Corp.
3. Larsen's Manufacturing Company.
4. Nystrom Inc.
5. Potter-Roemer.
6. Substitutions: Section 01 60 00 - Product Requirements.

B. Basis of Design: Activar - JL Industries - Academy Series.

C. Fire Extinguishers Cabinets: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
1. Fire Rating: Listed and labeled in accordance with ASTM E814 requirements for fire resistance rating of walls where being installed.

2. Provide fire extinguisher cabinets classified and labeled by UL for purpose specified and indicated.

D. Non-Fire Rated Cabinet Construction:
1. Formed aluminum; 0.036 inch thick base metal.

E. Fire Rated Cabinet Construction: Fire rating to be as required by rating of wall construction.
1. Steel; double wall or outer and inner boxes with minimum 5/8 inch thick fire barrier material.

F. Cabinet Trim and Installation Configuration:
1. Semi-Recessed Trim Type:
a. 2-1/2 inch projection from wall surface; rolled edge; 1-3/4 inch face width.

G. Cabinet Tub Size: Provide tube size as needed to accommodate required extinguisher and accessories content.

H. Door: Minimum 0.036 inch thick base metal formed to 5/8 inch thickness, reinforced for flatness and rigidity with nylon catch. Continuous hinge door for 180 degree opening. Pull to be surfaced mounted handle type with two through-door bolts.
1. Glazing: Acrylic plastic, clear, 1/8 inch thick, flat shape and set in resilient channel glazing gasket.
a. Full door glazed panel.
2. Signage:
a. Die cut vinyl letters, self adhering; uppercase helvetica font; vertical descending composition.
1) Application:
a) Reverse adhered on inside face of door glazing panel.
2) Letters color to be as selected by Architect from full range of options.

I. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors; no visible fasteners on exterior of cabinet.

J. Weld, fill, and grind joinery and components smooth.

K. Finishes:
1. Non-Fire Rated Cabinets:
a. Cabinet Exterior Trim and Door Finish:
1) Aluminum Construction: Clear anodized finish.
b. Cabinet Tub Finish: Match exterior material and finish.
2. Fire Rated Cabinets:
a. Cabinet Exterior Trim, Door, and Tub Finish:
1) Steel Construction: Powder coat finish; color as selected by Architect from manufacturer's full range.

2.3 ACCESSORIES

A. Extinguisher Brackets:
1. Formed stainless steel.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 73 00 - Execution: Verification of existing conditions before starting work.

B. Verify locations and mounting heights for each unit.

C. Verify rough openings for cabinets are correctly sized and located.

3.2 PREPARATION

A. Section 01 73 00 - Execution: Prepare field conditions and existing construction for installation of work of this Section.

B. Prepare materials to be installed and equipment to be used during installation.

3.3 INSTALLATION

A. Section 01 73 00 - Execution: Related to installation of Work.

B. Install cabinets plumb and level in wall openings and as indicated on Drawings.

C. Install wall brackets at location indicated on Drawings.

D. Secure rigidly in place.

E. Install extinguishers and accessories in cabinets or on wall brackets as indicated on Drawings.

3.4 CLEANING

A. Section 01 73 00 - Execution and Section 01 77 00 - Closeout Procedures.

B. Clean installed work in accordance with manufacturer's recommendations including cleaning procedures and materials.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 73 00 - Execution: Protecting installed construction.

B. Protect installed construction from damage.

3.6 SCHEDULES

A. Fire Extinguisher Cabinet Locations: As indicated on Drawings.
   1. In fire rated construction, provide fire rated cabinets in compliance with the requirements for the fire rated construction.

B. Fire Extinguisher Locations by Type:
   1. Type K and Type A:B:C fire extinguishers:
      a. Kitchens (bracket installed if no cabinet indicated).
   2. Type A:B:C fire extinguishers:
      a. All locations not indicated to be other Type. Areas include, but are not limited to the following:
         1) Corridors.
         2) Assembly Areas.
         3) Work Areas.
         4) Mechanical Rooms (bracket installed if no cabinet indicated).
         5) Electrical Rooms (bracket installed if no cabinet indicated).
         6) Elevator Equipment Rooms (bracket installed if no cabinet indicated).
         7) Lawn Equipment Sheds (bracket installed if no cabinet indicated).

C. Fire Extinguisher Quantities by Type:
   1. Type K: Two (2) each.
   2. Type A:B:C: Thirty Five (35) each.

END OF SECTION

SECTION 10 51 13
METAL LOCKERS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes factory manufactured metal lockers and accessories.
   1. Kitchen Staff Lockers.
   2. Athletic Lockers.
   3. Vocational Lockers.
   4. Benches.

1.2 REFERENCES

A. Americans with Disabilities Act (ADA):
   1. ADA Standards - ADA Standards for Accessible Design; Current Edition.

B. ASTM International (ASTM):
   1. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
   2. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2023.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate locker plan layout, elevations, filler panels, ADA compliant lockers, numbering plan, and combination lock code.
   1. Indicate layout and dimensions for locker benches.

C. Product Data: Submit data on locker types, sizes, and accessories.

D. Samples for Initial Selection: Two manufacturer's color charts illustrating the full range of finishes and colors available for products with factory-applied finishes; submit for Architect’s initial selections.

E. Samples for Verification: From the Architect’s initial selections, prepare and submit two samples for each selected finish and color; samples on same product material type indicated for final Work; each sample 4 x 4 inches. Where finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.

F. Manufacturer’s Installation Instructions: Submit installation template and attachment devices.

1.4 DELIVERY, STORAGE, AND PROTECTION

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Protect components and accessories from warping, moisture, and other damage.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers:
1. Art Metal Products.
2. ASI Storage Solutions.
3. List Industries, Inc.
4. Lyon Workspace Products.
5. Penco Products, Inc.
6. Republic Storage Systems Company.
7. Tennsco Storage.
8. Substitutions: Section 01 60 00 - Product Requirements.

2.2 LOCKER TYPES

A. Kitchen Staff Lockers:
1. Class: Conventional.
2. Configuration: Refer to Drawings for locker configurations.
3. Width:
   a. 12 inches.
4. Depth:
   a. 15 inches.
5. Height:
   a. 72 inches; sloped top.
6. Tiers:
   a. Double tier.
7. Base Mounting:
   a. Concrete Base with face finish to match adjacent wall base in room.
8. Base Height: 6 inches, unless indicated otherwise on Drawings.
9. Ventilation Method:
   a. Door louver vents at upper and lower portion of door.
10. Accessories:
   a. Two (2) double prong wall hooks.
   b. Rubber door silencers.
   c. Metal plate formed shelf.
11. Metal: Steel.
   a. Sides, Bottom, Top, and Shelf: 16 gauge.
   b. Back: 18 gauge.
   c. Doors Face and Frame: 14 gauge.
   d. Hinges: 0.074 inch thick, 2 inches long or continuous, five-knuckle.
   e. Base and Trim: 18 gauge.

B. Athletic Lockers: Includes Changing Room lockers.
1. Class: Conventional.
2. Configuration: Refer to Drawings for locker configurations.
3. Width:
   a. 12 inches.
4. Depth:
   a. 15 inches.
5. Height:
   a. 72 inches; sloped top.
6. Tiers:
   a. Double tier.
7. Base Mounting:

a. Concrete Base with face finish to match adjacent wall base in room.
8. Base Height: 6 inches, unless indicated otherwise on Drawings.
9. Ventilation Method:
a. Diamond shaped perforations on sides and door; 3/4 x 1-1/2 inch perforations.
10. Accessories:
a. Three (3) single prong wall hooks.
b. One (1) double prong ceiling hooks.
c. Rubber door silencers.
d. Metal plate formed shelf.
11. Metal: Steel.
a. Sides, Bottom, Top, and Shelf: 16 gauge.
b. Back: 18 gauge.
c. Doors Face and Frame: 14 gauge.
d. Hinges: 0.074 inch thick, 2 inches long or continuous, five-knuckle.
e. Base and Trim: 18 gauge.

2.3 LOCKER FABRICATION

A. General:
1. Factory Assembled Construction: Made of formed sheet steel; metal edges finished smooth without burrs; finished inside and out.
a. Locker Body Components: Formed and flanged from steel sheet of the following type and thicknesses indicated:
1) Commercial Steel (CS), Type B, supplied for exposed applications and complying with ASTM A1008/A1008M and the following:
a) Zinc-Coated by the Hot-Dip Process: Comply with ASTM A653/A653M:
(1) Coating designation G60/Z180.
(2) Coating designation G90/Z275.
b) Uncoated.
2. ADA Compliance: Applies to lockers indicated as ADA accessible.
a. Comply with ICC A117.1 and ADA Standards.
b. Decal with international symbol of accessibility on face of locker.
c. Shelves: Adjustable type.
d. Latches and Locks: ADA compliant.
3. Provide locker units constructed with components capable of being securely anchored to the supporting substrate. Reinforce components as required to anchor units to withstand imposed loads.
4. Provide metal top, end, closure, and filler panels; 16 gauge.
5. Finish edges smooth without burrs.
6. Finish Type: Metal finish to be on all surfaces and components.
a. Powder coat; minimum 2 mil dry film thickness.
7. Colors: To be selected by Architect from manufacturer's full range.

B. Locker Body:
1. Formed and flanged; with steel stiffener ribs; electric spot welded.
2. Provide finished heavy gauge steel end panel for exposed end lockers.

C. Frames: Formed channel shape, welded, and ground flush, welded to body, resilient gaskets and latching for quiet operation.

D. Doors: Hollow channel construction, 1-3/16 inch thick; welded construction, channel reinforced top and bottom with intermediate stiffener ribs, grind, and finish edges smooth. Provide rubber silencers.

E. Hinges: Welded to door frame and securely fastened to door.

1. Two hinges for doors less than 42 inches high.
2. Three hinges for doors 42 - 60 inches high.
3. Continuous hinge for doors greater than 60 inches high, or 20 inches wide, or lockers located in athletic/changing room locations, or workshop locations.

F. Door Number Plates: Provide rectangular shaped aluminum plates. Form numbers 3/8 inch high of block font style, in contrasting color. Provide ADA designation for ADA compliant lockers.

2.4 LOCKER LATCHES AND LOCKS

A. Latch Types: Recessed type; formed stainless steel; unless indicated otherwise.
1. Recessed type is always to be ADA compliant, even if locker is not indicated to be ADA accessible.

B. Lock Types:
1. Built-In Locks:
a. Master combination lock.
b. Five preset combination changes.
c. Master keyed in front/center of spin-dial.
d. Master keys.
e. LH and RH reversible.

2.5 BENCHES

A. ADA Compliance: Provide ADA compliant benches where ADA accessibility is indicated on Drawings.

B. Size and Configuration: As indicated on Drawings.

C. Components:
1. Seat: Laminated solid birch or maple wood strips, sealed and varnished.
2. Pedestals:
a. Stationary type.
3. Metal Components:
a. Stainless steel, satin finish.
4. Fasteners and Anchors: Stainless steel.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 73 00 - Execution: Verification of existing conditions before starting work.

B. Verify that conditions, finishes, substrates, and anchoring construction are adequate and acceptable to receive Work of this Section.

3.2 PREPARATION

A. Section 01 73 00 - Execution: Prepare field conditions and existing construction for installation of work of this Section.

B. Prepare materials to be installed and equipment to be used during installation.

3.3 INSTALLATION

A. Section 01 73 00 - Execution: Related to installation of Work.

B. Install lockers plumb and square. Joints between adjacent surfaces to be flush hairline joints.

C. Secure lockers with anchor devices to suit substrate construction.
   1. Minimum Pullout Force: 100 lb.

D. Bolt adjoining locker units together to provide rigid installation.

E. Install finished accessories, end panels, filler panels, and bases.

F. Replace components that are damaged, not fitting properly or not operating smoothly.

3.4 ADJUSTING

A. Section 01 73 00 - Execution: Starting, testing, adjusting, and balancing.

B. Adjust doors and latches to operate smoothly and without binding.

C. Adjust built-in locks (if any) to operate smoothly and without binding of dial or key.

D. Touch-up with factory-supplied paint and repair or replace damaged products before substantial completion.

3.5 CLEANING

A. Section 01 73 00 - Execution and Section 01 77 00 - Closeout Procedures: Related to cleaning.

B. Clean locker interiors and exterior surfaces.

3.6 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 73 00 - Execution: Protecting installed construction.

B. Protect the Work from damage.

END OF SECTION

Construction Documents 6/12/24

SECTION 10 73 16
CANOPIES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Factory finished metal canopies suspended from building structure.

B. Related Requirements:
   1. Section 10 73 26 - Walkway Coverings: Walkway coverings supported by columns.
   2. Division 05 - Metals: Sections related to structural steel for supporting structure.
   3. Division 08 - Openings: Sections related to framed opening infill.

1.2 REFERENCES

A. American Architectural Manufacturers Association (AAMA):
   1. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2020.
   2. AAMA 612 - Voluntary Specification, Performance Requirements, and Test Procedures for Combined Coatings of Anodic Oxide and Transparent Organic Coatings on Architectural Aluminum; 2020, with Errata 2022.
   3. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.
   4. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.
   5. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site; 2015.

B. American Society of Civil Engineers (ASCE):
   1. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

C. ASTM International (ASTM):
   1. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.
   2. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

D. American Welding Society, Inc. (AWS):
   1. AWS D1.2/D1.2M - Structural Welding Code - Aluminum; 2014, with Errata 2020.

1.3 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

B. Coordinate base components and requirements for attachment and anchorage to structure.

C. Coordinate work of other Sections that interface and are related to the work of this Section (drainage, sidewalks, building openings, exterior walls, roofing, soffits, fascia, lighting, etc.).

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Manufacturer's product information, specifications and installation instructions for components and accessories.

C. Shop Drawings: Indicate system and component profiles, sizes, connection attachments, anchorage, size, and type of fasteners; anticipated deflection under load; affected related work; expansion and contraction joint locations and details; drainage details and flow diagrams; field welding; and accessories.
   1. Prepare shop drawings indicating attachment system, framing, transverse cross sections, covering and trim details, and installation details to clearly indicate proper assembly of components.
   2. Shop drawings and engineering data indicating compliance with requirements of this Section are to be designed and sealed by a licensed professional Engineer. Include test results of previous testing meeting performance criteria, and other supportive data.

D. Engineering Certification: Submit written certification prepared and signed by a licensed professional Engineer indicating compliance with applicable codes and Performance Requirements indicated in this Section.

E. Samples for Initial Selection: Two manufacturer's color charts illustrating the full range of finishes and colors available for products with factory-applied color finishes; submit for Architect's initial selections.

F. Samples for Verification: From the Architect's initial selections, prepare and submit two samples for each selected finish and color; samples on same product material type indicated for final work; each sample 4 x 4 inches. Where finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.

1.5 QUALITY ASSURANCE

A. Designer Qualifications: Design of canopy systems included in this Section are to be designed and sealed by a licensed Professional Engineer, experienced in design of work of this type and licensed in the State in which the Project is located. Engineer is to certify that all applicable code requirements have been met. Engineer may be in the employ of the manufacturer of the covering systems, provided Engineer is compliant with the above registration requirement.

B. Comply with the current provisions of the following unless otherwise indicated:
   1. Applicable codes and authorities having jurisdiction (AHJ).
   2. AWS (American Welding Society) standards for structural welding.

C. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five (5) years documented experience.

D. Installer Qualifications: Company specializing in performing the work specified in this Section with minimum five (5) years documented experience.

E. Single Source Requirement: If project includes Section 10 73 16 - Canopies and Section 10 73 26 - Walkway Coverings, manufacturer to be same and installer to be same for both Sections.

1.6 DELIVERY, STORAGE, AND PROTECTION

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Comply with AAMA CW-10.

C. Protect prefinished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather. Provide for adequate ventilation through wrappings.

1.7 WARRANTY

A. Section 01 77 00 - Closeout Procedures: Product warranties.

B. Provide five (5) year manufacturer's warranty for finish.

C. Provide manufacturer's standard one (1) year warranty that includes, but is not limited to, coverage for structural performance, water tightness and finish.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Design system and size components, and anchorage to safely withstand Live Loads, Snow Loads, Wind Loads (+ and -), and Seismic Loads as indicated on Drawings for the Structural Design Criteria and in compliance with ASCE 7 and the State Building Code for the State in which the project is located.

B. System to provide for expansion and contraction within system components caused by a cycling temperature range of 120 degrees F without causing detrimental effects to system or components.

C. System to accommodate, without damage to system or components, movement within system, movement between system and perimeter framing components, dynamic loading and release of loads, and deflection of structural support framing.

D. Conform to applicable code for fire resistance ratings for items.

2.2 MANUFACTURERS

A. Manufacturers:
1. AVAdek, Inc.
2. Dittmer Architectural Aluminum.
3. Mitchell Metals.
4. Mapes Architectural Products.
5. Peachtree Protective Covers.
6. Perfection Architectural Systems, Inc.
7. Tennessee Valley Metals, Inc., East Coast TVM.
8. Substitutions: Section 01 60 00 - Product Requirements.

2.3 MATERIALS

A. Extruded Aluminum: ASTM B221; 6063 alloy, T6 temper typical; 6061 alloy, T6 temper for extruded structural members.

B. Sheet Aluminum: ASTM B209/B209M; 6061 alloy, T6 temper.

C. Fasteners:
1. Deck Screws (rivets not permitted): Type 18-8 non-magnetic stainless steel sealed with a neoprene "O" ring beneath 5/8 inch outside dimension, conical washer.
2. Rivets: Size 3/16 x 1/2 inch grip range aluminum rivets with aluminum mandrel.
3. Bolts: All bolts, nuts, and washers to be 18-8 non-magnetic stainless steel.
4. Tek Screws: Not permitted.

2.4 COMPONENTS

A. Decking: Extruded self-flashing aluminum sections; interlocking into a watertight composite unit. Extrusion thickness to be a required to withstand imposed loads.

B. Soffit Type: Flush bottom, unless indicated otherwise on Drawings.

C. Fascia: Extruded aluminum.
1. For integral fascia and structural frame extrusion, 0.125 inch thick, minimum.
2. For separate fascia extrusion secured to structural frame, 0.050 inch thick, minimum.
3. Shape and size to be as indicated on Drawings.

D. Flashing: Extruded aluminum, 0.040 inch thick; same finish as for system components; secured with concealed fastening method.

2.5 FABRICATION

A. Field Measurements: Verify actual supporting and adjoining construction by field measurements before fabrication; and indicate recorded measurements on final Shop Drawings. Verify that supporting construction is as required for support of the Sun Control Devices. Coordinate construction to ensure that sun control assemblies fit properly to supporting and adjoining construction and coordinate schedule with construction progress to avoid delaying the Work.
1. Established Dimensions: Where field measurements cannot be made without delaying the Work, coordinate related construction to ensure that Sun Control Devices correspond to established dimensions and construction.

B. Fabricate assemblies to comply with design as indicated on Drawings.

C. Fit and shop assemble components in largest practical sizes, for delivery to site.

D. Fabricate components with joints tightly fitted and secured. Provide allowance for expansion and contraction of entire system.

E. Provide drainage pathway without leaks and to point of drainage discharge.

F. For canopies suspended from building (and without columns for drainage), provide for drainage openings with water diverters along bottom of canopy outer edge member. Drainage openings to be as indicated on Drawings. If drainage openings are not indicated on Drawings, locate drainage openings away from building face and not in direct line of door openings.

G. Arrange fasteners, attachments and jointing to ensure concealment from view.

H. Supply components required for anchorage of framing. Fabricate anchors and related components of same material and finish as framing, except where specifically noted otherwise.

I. Continuously seal joined pieces by continuous welds.

J. Welding In accordance with ANSI/AWS D1.2/D1.2M.

K. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, hairline, and waterproof. Ease exposed edges to small uniform radius.

L. Accurately form components to suit each other and to building structure.

M. Deck Construction: Deck shall be manufactured of extruded modules that interlock in a self-flashing manner. Interlocking joints shall be positively fastened at not less than 18 inches o.c. creating a monolithic structural unit capable of developing the full strength of the sections. The fastenings must have minimum shear strength of 350 pounds each. Deck shall be assembled with sufficient camber to offset dead load deflection.

2.6 ACCESSORIES

A. Fittings: Elbows, T-shapes, wall brackets; cast aluminum.

B. Splice Connectors: Concealed spigot; cast aluminum.

C. Struts: Manufacturer's standard rod type and material.

D. Wall Brackets: Manufacturer's standard decorative type for mounting in wall structure, unless shape, profile, or configuration is otherwise indicated on Drawings.

E. Exposed Fasteners: Flush countersunk stainless steel screws, bolts, and rivets; finish to be same as factory finish indicated.

F. Protective Coating for dissimilar materials: Clear acrylic; two coats; compatible with materials to be coated.

2.7 FACTORY FINISHING

A. All surfaces of components, fabrications, and accessories to be factory finished to match colors selected by Architect from full range of colors.

B. Painted Aluminum Finish: AA-M12C12R1x non-specular as fabricated mechanical finish, chemically cleaned, and prepared for applied coating; with organic coating.
   1. Superior Performing Organic Coatings: AAMA 2605, thermally cured polyvinylidene fluoride (PVDF) resin-based coating, fluoropolymer finish containing minimum 70 percent PVDF resins.
      a. Number of Coats:
         1) Two (2) coat system, 1.2 mil minimum total dry-film thickness.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 73 00 - Execution: Verification of existing conditions before starting work.

B. Verify that substrates and anchor conditions are acceptable and are ready to receive work.

C. Verify dimensions, tolerances, and method of attachment with other work.

3.2 PREPARATION

A. Section 01 73 00 - Execution: Prepare field conditions and existing construction for installation of work of this Section.

B. Prepare materials to be installed and equipment to be used during installation.

3.3 INSTALLATION

A. Section 01 73 00 - Execution: Related to installation of Work.

B. Install as indicated on Drawings and in accordance with Engineer's and manufacturer's instructions.

C. Install components plumb and level, accurately fitted, free from distortion or defects.

D. Apply two coats of clear acrylic coating to aluminum surfaces in contact with dissimilar materials and cementitious embedment. Application to be concealed from view.

E. Install anchors required for connecting framing to structure.

3.4 ERECTION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation from Plumb: 1/4 inch per story, non-cumulative.

C. Maximum Misalignment from True Position: 1/4 inch.

D. Maximum Variation from Plane: 1/4 inch every 10 feet, non-cumulative.

E. Maximum Variation from Alignment of Two Adjoining Members Abutting in Plane: 0.015 inch.

3.5 CLEANING

A. Section 01 73 00 - Execution and Section 01 77 00 - Closeout Procedures: Clean installed work and comply with manufacturer's recommendations.

B. Clean installed work in accordance with manufacturer's recommended materials and procedures.

3.6 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 73 00 - Execution: Protect installed construction.

END OF SECTION

SECTION 10 73 26

WALKWAY COVERINGS (ALTERNATE 1 & 2)

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Factory finished metal walkway coverings with columns.

B. Related Requirements:
   1. Section 03 30 00 - Cast-in-Place Concrete: Concrete for column footings.
   2. Section 10 73 16 - Canopies: Suspended from building structure.

1.2 REFERENCES

A. American Architectural Manufacturers Association (AAMA):
   1. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2020.
   2. AAMA 612 - Voluntary Specification, Performance Requirements, and Test Procedures for Combined Coatings of Anodic Oxide and Transparent Organic Coatings on Architectural Aluminum; 2020.
   3. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2021.
   4. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2020.
   5. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site; 2015.

B. American Society of Civil Engineers (ASCE):
   1. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Coad or Reference Standard.

C. ASTM International (ASTM):
   1. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.
   2. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

D. American Welding Society, Inc. (AWS):
   1. AWS D1.2/D1.2M - Structural Welding Code - Aluminum; 2014, Errata 2020.

1.3 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

B. Coordinate base components and requirements for attachment and anchorage to structure.

C. Coordinate work of other Sections that interface and are related to the work of this Section (drainage, sidewalks, curbs, building openings, exterior walls, roofing, soffits, fascia, lighting, etc.).

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Manufacturer's product information, specifications and installation instructions for components and accessories.

C. Shop Drawings: Indicate system and component profiles, sizes, connection attachments, anchorage, footings, size, and type of fasteners; anticipated deflection under load; affected related work; expansion and contraction joint locations and details; drainage details and flow diagrams; field welding; and accessories.
   1. Prepare shop drawings indicating attachment system, column and gutter beam framing, transverse cross sections, covering and trim details, and installation details to clearly indicate proper assembly of components.
   2. Shop drawings and engineering data indicating compliance with requirements of this Section are to be designed and sealed by a licensed professional Engineer. Include test results of previous testing meeting performance criteria, and other supportive data.

D. Engineering Certification: Submit written certification prepared and signed by a licensed professional Engineer indicating compliance with applicable codes and Performance Requirements indicated in this Section.

E. Samples for Initial Selection: Two manufacturer's color charts illustrating the full range of finishes and colors available for products with factory-applied color finishes; submit for Architect's initial selections.

F. Samples for Verification: From the Architect's initial selections, prepare and submit two samples for each selected finish and color; samples on same product material type indicated for final work; each sample 4 x 4 inches. Where finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.

1.5 QUALITY ASSURANCE

A. Designer Qualifications: Design of canopy systems included in this Section are to be designed and sealed by a licensed Professional Engineer, experienced in design of work of this type and licensed in the State in which the Project is located. Engineer is to certify that all applicable code requirements have been met. Engineer may be in the employ of the manufacturer of the covering systems, provided Engineer is compliant with the above registration requirement.

B. Comply with the current provisions of the following unless otherwise indicated:
   1. Applicable codes and authorities having jurisdiction (AHJ).
   2. AWS (American Welding Society) standards for structural welding.

C. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five (5) years documented experience.

D. Installer Qualifications: Company specializing in performing the work specified in this Section with minimum five (5) years documented experience.

E. Single Source Requirement: If project includes Section 10 73 16 - Canopies and Section 10 73 26 - Walkway Coverings, manufacturer and installer to be same for both Sections.

1.6 DELIVERY, STORAGE, AND PROTECTION

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Comply with AAMA CW-10.

C. Protect prefinished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather. Provide for adequate ventilation through wrappings.

1.7 WARRANTY

A. Section 01 77 00 - Closeout Procedures: Product warranties.

B. Provide ten (10) year manufacturer's warranty for finish.

C. Provide manufacturer's standard one (1) year warranty that includes, but is not limited to, coverage for structural performance, water tightness and finish.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Design system and size components, anchorage, and footings to safely withstand Live Loads, Snow Loads, Wind Loads (+ and -), and Seismic Loads as indicated on Drawings for the Structural Design Criteria and in compliance with ASCE 7 and the State Building Code for the State in which the project is located.

B. System to provide for expansion and contraction within system components caused by a cycling temperature range of 120 degrees F without causing detrimental effects to system or components.

C. System to accommodate, without damage to system or components, movement within system, movement between system and perimeter framing components, dynamic loading and release of loads, and deflection of structural support framing.

D. Conform to applicable code for fire resistance ratings for items.

2.2 MANUFACTURERS

A. Manufacturers:
1. AVAdek, Inc.
2. Dittmer Architectural Aluminum.
3. Mitchell Metals.
4. Mapes Architectural Products.
5. Peachtree Protective Covers.
6. Perfection Architectural Systems, Inc.
7. Tennessee Valley Metals, Inc., East Coast TVM.
8. Substitutions: Section 01 60 00 - Product Requirements.

2.3 MATERIALS

A. Extruded Aluminum: ASTM B221; 6063 alloy, T6 temper; 6061 alloy, T6 temper for extruded structural members.

B. Sheet Aluminum: ASTM B209/B209M; 6061 alloy, T6 temper.

C. Fasteners:
1. Deck Screws (rivets not permitted): Type 18-8 non-magnetic stainless steel sealed with a neoprene "O" ring beneath 5/8 inch outside dimension, conical washer.
2. Rivets: Size 3/16 x 1/2 inch grip range aluminum rivets with aluminum mandrel.
3. Bolts: All bolts, nuts, and washers to be 18-8 non-magnetic stainless steel.
4. Tek Screws: Not permitted.

2.4 COMPONENTS

A. Columns: Extruded aluminum tubing with radius corners; size and shape as shown on Drawings; fabricated to allow internal drainage to discharge. Unless shown otherwise on the drawings.

1. Drainage and Discharge: Water shall drain internally from deck to beams to columns, for connection and discharge into below-grade level storm drainage system as indicated on Drawings.
   a. If no below-grade storm drainage system is indicated for connection and discharge, provide for discharge from column base at grade level in opposite direction of pedestrian walk path. Discharge opening with internal diverter required for drainage discharge. Circular downspout opening in column is not acceptable.

B. Beams: Open-top tubular extruded aluminum shape as indicated on Drawings; top edges thickened for strength and designed to receive deck members in self-flashing manner. Extrusion thickness to be a required to withstand imposed loads. Structural ties shall be installed in tops of all beams.

C. Decking: Extruded self-flashing aluminum sections; interlocking into a watertight composite unit. Extrusion thickness to be a required to withstand imposed loads.

D. Soffit Type: Flush bottom, unless indicated otherwise on Drawings.

E. Fascia: Extruded aluminum.
   1. For integral fascia and structural frame extrusion, 0.125 inch thick, minimum.
   2. For separate fascia extrusion secured to structural frame, 0.050 inch thick, minimum.
   3. Shape and size to be as indicated on Drawings.

F. Flashing: Extruded aluminum, 0.040 inch thick; same finish as for system components; secured with concealed fastening method.

2.5 FABRICATION

A. Field Measurements: Verify actual supporting and adjoining construction by field measurements before fabrication; and indicate recorded measurements on final Shop Drawings. Verify that supporting construction is as required for support of the Sun Control Devices. Coordinate construction to ensure that sun control assemblies fit properly to supporting and adjoining construction and coordinate schedule with construction progress to avoid delaying the Work.
   1. Established Dimensions: Where field measurements cannot be made without delaying the Work, coordinate related construction to ensure that Sun Control Devices correspond to established dimensions and construction.

B. Fabricate assemblies to comply with design as indicated on Drawings.

C. Fit and shop assemble components in largest practical sizes, for delivery to site.

D. Fabricate components with joints tightly fitted and secured. Provide allowance for expansion and contraction of entire system.

E. Provide drainage pathway without leaks and to point of drainage discharge.

F. Arrange fasteners, attachments and jointing to ensure concealment from view.

G. Supply components required for anchorage of framing. Fabricate anchors and related components of same material and finish as framing, except where specifically noted otherwise.

H. Continuously seal joined pieces by continuous welds.

I. Welding In accordance with ANSI/AWS D1.2/D1.2M.

J. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, hairline. and waterproof. Ease exposed edges to small uniform radius.

K. Accurately form components to suit each other and to building structure.

L. Deck Construction: Deck shall be manufactured of extruded modules that interlock in a self-flashing manner. Interlocking joints shall be positively fastened at not less than 18 inches o.c. creating a monolithic structural unit capable of developing the full strength of the sections. The fastenings must have minimum shear strength of 350 pounds each. Deck shall be assembled with sufficient camber to offset dead load deflection.

2.6 ACCESSORIES

A. Fittings: Elbows, T-shapes, wall brackets; cast aluminum.

B. Splice Connectors: Concealed spigot; cast aluminum.

C. Struts: Manufacturer's standard rod type and material.

D. Wall Brackets: Manufacturer's standard decorative type for mounting in wall structure, unless shape, profile, or configuration is otherwise indicated on Drawings.

E. Exposed Fasteners: Flush countersunk stainless steel screws, bolts, and rivets; finish to be same as factory finish indicated.

F. Protective Coating for dissimilar materials: Clear acrylic; two coats; compatible with materials to be coated.

2.7 FACTORY FINISHING

A. All surfaces of components, fabrications, and accessories to be factory finished to match colors selected by Architect from full range of colors. Account for max 2 (two) colors on canopy.

B. Painted Aluminum Finish: AA-M12C12R1x non-specular as fabricated mechanical finish, chemically cleaned, and prepared for applied coating; with organic coating.
   1. Superior Performing Organic Coatings: AAMA 2605, thermally cured polyvinylidene fluoride (PVDF) resin-based coating, fluoropolymer finish containing minimum 70 percent PVDF resins.
      a. Number of Coats:
         1) Three (3) coast system, 1.2 mil minimum total dry-film thickness.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 73 00 - Execution: Verification of existing conditions before starting work.

B. Verify that substrates and anchor conditions are acceptable and are ready to receive work.

C. Verify that adjacent, at-grade and sub-grade construction is ready to receive work of this Section.

D. Verify dimensions, tolerances, and method of attachment with other work.

3.2 PREPARATION

A. Section 01 73 00 - Execution: Prepare field conditions and existing construction for installation of work of this Section.

B. Prepare materials to be installed and equipment to be used during installation.

3.3 INSTALLATION

A. Section 01 73 00 - Execution: Related to installation of Work.

B. Install as indicated on Drawings and in accordance with Engineer's and manufacturer's instructions.

C. Install components plumb and level, accurately fitted, free from distortion or defects.

D. Apply two coats of clear acrylic coating to aluminum surfaces in contact with dissimilar materials and cementitious embedment. Application to be concealed from view.

E. Install anchors required for connecting framing to structure and footings.

F. Rainwater Drainage Through Columns:
1. For downspout columns that are indicated to discharge rainwater into a subgrade storm drainage system, install watertight and as indicated on Drawings.
2. For downspout columns that are indicated to discharge rainwater onto finish grade, fill downspout columns with grout to discharge diverter level to prevent standing water.

G. Provide weep holes in non-draining columns at top of concrete to remove condensation.

3.4 ERECTION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation from Plumb: 1/4 inch per story, non-cumulative.

C. Maximum Misalignment from True Position: 1/4 inch.

D. Maximum Variation from Plane: 1/4 inch every 10 feet, non-cumulative.

E. Maximum Variation from Alignment of Two Adjoining Members Abutting in Plane: 0.015 inch.

3.5 CLEANING

A. Section 01 73 00 - Execution and Section 01 77 00 - Closeout Procedures: Clean installed work and comply with manufacturer’s recommendations.

B. Clean installed work in accordance with manufacturer’s recommended materials and procedures.

3.6 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 73 00 - Execution: Protect installed construction.

END OF SECTION

SECTION 10 75 00

FLAGPOLES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Flagpoles installed with in-ground foundation.

B. Related Requirements:
   1. Section 03 30 00 - Cast-in-Place Concrete: Concrete for base and foundation construction.

1.2 REFERENCES

A. ASTM International (ASTM):
   1. ASTM B241/B241M - Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube; 2022.

B. National Association of Architectural Metal Manufacturers (NAAMM):
   1. NAAMM FP 1001 - Guide Specifications for Design of Metal Flagpoles; 2007.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data on pole, accessories, and configurations.

C. Shop Drawings: Indicate detailed dimensions, attachment details, anchor requirements, imposed loads, and foundation details for in-ground installed flagpoles.
   1. Shop drawings and engineering data indicating compliance with requirements of this Section and applicable code requirements are to be designed and sealed by a Professional Engineer experienced in design of the work in this Section and licensed to perform structural engineering in the State in which the project is located.

D. Flag Designs: Submit drawings indicating design, colors, and fabrication details of flag(s) required.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 78 23 - Operation and Maintenance Data.

B. Operation and Maintenance Data: Submit Operation and Maintenance Data.

1.5 QUALIFICATIONS

A. Delegated Designer Requirement: Design flagpole, flagpole foundation, and anchorage under direct supervision of Professional Engineer experienced in design of the work in this Section and licensed in State in which the project is located.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Spiral wrap flagpole with protective covering and pack in protective shipping tubes or containers.

C. Protect flagpole and accessories from damage or moisture.

1.7 SPARE PARTS AND MAINTENANCE PRODUCTS

A. Section 01 60 00 - Product Requirements: Extra materials, spare parts, and maintenance products.
   1. Keys to lockable cleat box.
   2. Specialty adjustment tools, if any required.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide flagpoles capable of withstanding the effects of wind loads as determined according to NAAMM FP 1001. Design for non-resonant safety factor of 2.5; to resist without permanent deformation at design wind speed as indicated on Drawings; with flag deployed and flag size as indicated in this Section.

2.2 FLAGPOLES - IN-GROUND MOUNTED TYPE

A. Manufacturers:
   1. American Flagpole.
   2. Concord Industries, Inc.
   3. Ewing.
   4. Morgan-Francis Flagpole.
   5. Pole-Tech Company, Inc.

B. Aluminum: ASTM B241/B241M, 6063 alloy, T6 temper.

C. Flagpole Quantities Required and Configuration Table: Tapered design.

Quantity Required	Above Ground Height.	Butt Diameter	Wall Thickness	Finial Ball Dia.	Flag Size
1	50 feet	10 inches min**	0.188 inch min**	4 inches	10 x 15 feet
** Minimum dimension subject to increase in accordance with Engineer's Design and Performance Requirements.					

D. Accessories:
   1. Flag Types: Flag graphic design is to comply with the referenced entity's official design. Fabrication to be of nylon fabric with hemmed edges and brass grommets. Provide one (1) each of the following flags.
      a. United States flag. Design in accordance with stars and stripes design.
      b. State flag. Design in accordance with State in which project is located.
      c. County flag. Design in accordance with County in which project is located.
   2. Halyard: External type; minimum 3/8 inch diameter nylon, braided, with stainless steel or bronze core. Provide non-corrosive hardware required to display (attach/fly) the following quantity of flags per flagpole.
      a. One (1) flag per flagpole.
   3. Finial Ball: Aluminum; finish to match flagpole.
   4. Truck Assembly: Cast aluminum; revolving, stainless steel ball bearings, non-fouling.
   5. Cleats: 9 inch size, aluminum with stainless steel fastenings, two for each halyard.
   6. Cleat Box: Aluminum, with built-in hinge and lockable assembly, attached to pole with tamper proof screws inside box.
   7. Foundation Tube Sleeve: Minimum 16 gauge corrugated galvanized steel; depth as required for loads imposed on flagpole.
   8. Pole Base Attachment: Sleeve; aluminum base with base cover.
   9. Lightning Ground Cable: Copper No. 6 AWG, soft drawn.

E. Factory Finishing:
   1. Aluminum: Anodized to clear color.
   2. Finial: Spun finish.
   3. Metal Surfaces in Contact with Concrete: Coat with asphaltic paint.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 73 00 - Execution: Verification of existing conditions before starting work.

B. Verify area is ready to receive work and dimensions are as required.

3.2 PREPARATION

A. Section 01 73 00 - Execution: Prepare field conditions and existing construction for installation of work of this section.

B. Prepare materials to be installed and equipment to be used during installation.

C. Coat metal sleeve surfaces below grade, in contact with cementitious surfaces, and in contact with dissimilar metals with asphaltic paint.

3.3 INSTALLATION

A. Section 01 73 00 - Execution: Related to installation of Work.

B. Install work in accordance with Delegated Design by Engineer and manufacturer's requirements.

C. Provide isolation barrier between dissimilar materials.

D. Electrically ground flagpole installation.

3.4 ERECTION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation from Plumb: 1 inch.

3.5 ADJUSTING

A. Section 01 73 00 - Execution: Adjusting.

B. Adjust operating devices so halyard and flag function smoothly.

END OF SECTION

Construction Documents 6/12/24

SECTION 11 21 73.10

COMMERCIAL LAUNDRY EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Clothes washer.
   2. Lint interceptor for clothes washer.
   3. Clothes dryer.

B. Related Requirements:
   1. Divisions 22, 23, and 24: Plumbing, venting, and electrical requirements.

1.2 REFERENCES

A. American Gas Association (AGA).

B. CSA Group (formerly Canadian Standards Association) (CSA).
   1. CSA Certified - Complies with AGA/CSA certification standards.

C. Electrical Testing Laboratories, a division of Intertek (ETL):
   1. ETL Intertek Certified - Complies with ETL certification standards.

D. National Fire Protection Association (NFPA):
   1. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
   2. NFPA 54 - National Fuel Gas Code; 2024.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Section 01 30 00 - Administrative Requirements: Requirements for coordination.
   2. Coordinate electrical requirements with Project's electrical service and connectivity.
   3. Coordinate plumbing requirements with Project's gas, water, and waste services and connectivity.

B. Pre-Installation Meetings:
   1. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.
   2. Convene minimum one week prior to commencing work of this Section. Review the work requirements, application procedures, quality control, testing and inspection and production schedule.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit product data for product indicated. Data to include, but is not limited to the following:
   1. Manufacturer's model number.
   2. Accessories and components.
   3. Clearance requirements for access and maintenance.
   4. Utility service connections for water, drainage, power, and fuel; include roughing-in dimensions.

C. Shop Drawings: Submit drawings including equipment locations, dimensions of equipment and spacing to adjacent construction, utility connections, and venting details through building construction.

D. Manufacturer's Installation Instructions: Indicate special installation criteria and interface with adjacent components.

E. Manufacturer's qualifications statement.

F. Installer's qualifications statement.

G. Warranties: Submit sample warranties.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 77 00 - Closeout Procedures.

B. Operation and Maintenance Data: Provide data for equipment provided.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain equipment from single source and from single manufacturer.

1.7 QUALIFICATIONS

A. Manufacturer Qualifications: Company specializing in manufacturing Products specified in this Section with minimum ten (10) years documented experience.

B. Installer Qualifications: Employer of workers trained and approved by equipment manufacturer for installation and maintenance of equipment indicated in this Section.
   1. Equipment service staff is to be located within 3 hours drive of Project site.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Deliver products in manufacturer's original packaging. Store materials in a dry, protected, well-vented area. Inspect product upon receipt and report damaged material immediately to delivering carrier and note such damage on the carrier's freight bill of lading.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Requirements before, during, and after the work.

B. Work and installation conditions to comply with equipment manufacturer's recommendations.

1.10 WARRANTY

A. Section 01 77 00 - Closeout Procedures: Product warranties.

B. Special Warranties: Manufacturer's standard form in which manufacturer agrees to repair or replace equipment or components that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: Five years from date of Substantial Completion on washer unit frame, wash cylinder, and shaft.
   2. Warranty Period: Three years from date of Substantial Completion on washer motor and other parts.
   3. Warranty Period: Two years from date of Substantial Completion on dryers.

PART 2 PRODUCTS

2.1 PERFORMANCE / DESIGN REQUIREMENTS

A. Certification: Provide electric and fuel-burning equipment and components that are evaluated by ETL Intertek or AGA/CSA, as applicable, for fire, electric shock, and casualty hazards according to applicable safety standards, and that are certified for compliance and labeled for intended use.

B. Regulatory Requirements: Provide and install equipment in compliance with the following:
   1. ANSI Z21 Series Standards for gas-burning appliances.
   2. NFPA 54 Standards.
   3. NFPA 70 Standards.

2.2 MANUFACTURERS

A. Manufacturers:
   1. Belco Athletic Laundry Equipment Co., Inc.
   2. Girbau, North America.
   3. Maytag Commercial.
   4. Substitutions: Section 01 60 00 - Product Requirements.

2.3 CLOTHES WASHER

A. Basis of Design: Belco Athletic Laundry Equipment.

B. Extractor type and front-loading unit; ETL Intertek certified.

C. Unit Size:
   1. Not greater than 39W x 46D x 62H inches.
      a. Drum Capacity: 55 lb to 60 lb.

D. Drum: Perforated stainless steel.

E. Controls: Rotary dial controls for water-fill levels, wash/rinse water temperatures, and variable-speed and fabric selectors.
   1. Wash Cycles: Five.
      a. Soak, extended wash, and advance.
      b. Three deep rinses, three intermediate extractions, and one final extraction.
      c. Normally closed drain valve operation to enable extended soak.
   2. Extraction: Maximum force 90 G.
   3. Wash Temperatures: Three settings.
   4. Speed Combinations: Four.

F. Electrical Power: 208 - 240 V, 60 Hz, single phase, inverter driven.

G. Motor: Manufacturer's standard with built-in overload protector, permanently lubricated main drive and motor bearings, and self-adjusting drive belt tensioning.

H. Features:
   1. Self-cleaning lint filter.
   2. Self-cleaning water inlet valves.
   3. Unbalanced-load compensator.
   4. Inlet Hoses: Minimum length 60 inches.
   5. Drain Hoses: Minimum length 48 inches.
   6. Automatic dispenser for bleach, fabric softener, and detergent.
   7. Spin-cycle safety switch.
   8. End-of-cycle signal.

I. Finish:
1. Unit Cabinet: Polyester powder coat or stainless steel.
2. Unit Front Panel: Stainless steel.

J. Temporary Finish Protection: Apply strippable temporary protective covering before shipping.

2.4 LINT INTERCEPTOR FOR CLOTHES WASHER

A. Basis of Design: H-M Company - Lint Interceptor.

B. Provide lint interceptor acceptable to authorities having jurisdiction, sized for discharge capacity of clothes washer, fabricated from corrosion-resistant material, accessible for routine maintenance.

2.5 CLOTHES DRYER

A. Basis of Design: Belco Athletic Laundry Equipment.

B. Front-Loading Unit:
1. Gas unit comply with AGA/CSA and to be CSA certified.

C. Unit Size:
1. Match clothes washer in unit size and drum capacity.

D. Drum: Perforated stainless steel.

E. Controls: Rotary dial controls for drying cycle, temperatures, and fabric selectors.
1. Drying Temperatures: Preset controls with the following marked settings for automated controls adjusting to uniform makers' temperature setting directions:
a. Game uniforms.
b. Practice uniforms.
c. Towels.
2. Timer: 60-minute, with 5-minute cool down.

F. Electrical Power:
1. Gas Dryer:
a. As indicated on Drawings.

G. Dryer Fan: 3/4 HP motor, 750 CFM, fully enclosed, fan-cooled.

H. Features:
1. Preheating chamber for make-up air.
2. Drying compartment for athletic gear.
3. Removable lint filter.
4. End-of-cycle signal.
5. Interior drum light.

I. Finish:
1. Unit Cabinet:
a. Match clothes washer.
2. Unit Front Panel:
a. Match clothes washer.
3. Temporary Finish Protection: Apply strippable temporary protective covering before shipping.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 73 00 - Execution: Verification of existing conditions before starting work.

B. Verify that field measurements are as required.

C. Examine substrates and conditions for compliance with requirements for installation tolerances, utility connections, and other conditions affecting installation and performance of equipment.

D. Examine walls, ceilings, and roofs for suitable conditions where dryer vent outlets will be installed.

E. Examine products to be installed for damage and other conditions detrimental to completion of the Work.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Section 01 73 00 - Execution: Prepare field conditions and existing construction for installation of Work of this Section.

B. Prepare materials to be installed and equipment to be used during installation.

3.3 INSTALLATION

A. Section 01 73 00 - Execution: Related to installation of Work.

B. Install the Work in compliance with the design requirements, applicable codes, manufacturer's recommendations, and the Contract Documents.

C. Install dryer venting complying with applicable codes and manufacturer's recommendations.

D. Built-in Equipment: Securely anchor units to supporting structure with manufacturer-approved fasteners. Verify that clearances are adequate for proper functioning and that rough openings are completely concealed.

E. Utilities: Refer to Divisions 22, 23, and 26 for plumbing, venting, and electrical requirements.

3.4 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Monitor quality of installation, inspection, and testing.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:
1. Perform visual, mechanical, and electrical inspection and testing for each appliance according to manufacturers' written recommendations. Certify compliance with each manufacturer's appliance-performance parameters.
2. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After installation, start units to confirm proper operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and components.

D. Equipment will be considered defective if it does not pass tests and inspections.

E. Prepare and report results of tests and inspections.

3.5 ADJUSTING

A. Section 01 73 00 - Execution: Starting, testing, adjusting, and balancing.

B. Adjust operating components to smooth operation without binding.

3.6 CLEANING

A. Section 01 73 00 - Execution and Section 01 77 00 - Closeout Procedures.

B. Clean installed Work in accordance with manufacturer's recommendations including cleaning procedures and materials.

3.7 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 73 00 - Execution: Protecting installed construction.

B. Protect installed construction from damage and unauthorized tampering.

3.8 DEMONSTRATION AND TRAINING

A. Section 01 79 00 - Demonstration and Training.

B. Engage a factory-authorized service representative to provide demonstration and training to Owner regarding adjusting, operation, and maintenance of the Work of this Section.

END OF SECTION

SECTION 11 30 13
RESIDENTIAL APPLIANCES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes residential appliances with installation including connections to utilities.

B. Related Requirements:
   1. Division 22 - Plumbing: Coordinate equipment plumbing requirements.
   2. Division 23 - HVAC: Coordinate equipment venting requirements.
   3. Division 26 - Electrical: Coordinate equipment electrical requirements.

1.2 REFERENCES

A. American Gas Association (AGA):
   1. AGA Certification Seal.

B. National Electrical Manufacturers Association (NEMA):
   1. NEMA Standards; Current.

C. Underwriters Laboratories Inc. (UL):
   1. UL (DIR) - Online Certification Directory; Current Edition.

D. U.S. Environmental Protection Agency (EPA):
   1. Energy Star - Label Indicating Compliance With Certification Standards for EPA Energy Star Voluntary Labeling Program.

1.3 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

B. Coordinate plumbing, venting, and electrical work with requirements of appliances.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data on appliances; indicate configuration, sizes, materials, finishes, locations, and utility connections and locations.

C. Shop Drawings:
   1. Indicate in large scale detail, fabricated equipment showing construction methods, types and gages of metal, hardware and fittings, plan, front elevation, minimum of one cross-section. Indicate verification that the projects planned provisions for utilities, ventilation and connectivity are compliant with the requirements of the appliance and/or device, to include types, sizes, locations, and accessibility.
   2. Illustrate complicated parts of typical items in cut-away perspective.
   3. For control systems, indicate service connections, characteristics, and wiring diagrams.

D. Samples: Submit samples illustrating manufacturer's full range of color and finish options for selection by Architect.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

F. Manufacturer's Installation Instructions: Submit special procedures for built-in items and perimeter conditions requiring special attention.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 77 00 - Closeout Procedures.

B. Operation and Maintenance Data: Submit manufacturer's operating instructions for specified equipment and care and maintenance of finished surfaces.

1.6 QUALITY ASSURANCE

A. Electric Appliances: Listed and labeled by UL (DIR) and complying with NEMA Standards.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Store products clear of floor in manner to prevent damage.

C. Coordinate size of access and route to place of installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers:
1. Frigidaire Products.
2. GE Appliances.
3. LG Electronics.
4. Whirlpool Corporation.
5. Substitutions: Section 01 60 00 - Product Requirements.

B. Basis of Design: Refer to appliance types indicated.

2.2 KITCHEN APPLIANCES

A. Refrigerator/Freezer:
1. Locations: As indicated on Drawings.
2. GE - Model GIE18GTNRWW (17.5 cu. ft. top-freezer refrigerator, icemaker, Energy Star, white).

B. Dishwasher:
1. Locations: As indicated on Drawings.
2. GE - Model GDF550PGRWW (built-In dishwasher, tall tub, SS tub/door liner, Energy Star, white).

C. Microwave Oven (countertop type):
1. Locations: As indicated on Drawings.
2. GE - Model PES7227DLWW (2.2 cu. ft. countertop microwave oven, glass turntable, white).

2.3 LAUNDRY APPLIANCES

A. Washer/Dryer:
1. Locations: As indicated on Drawings.
2. GE - Washer Model GTW465ASNWW (4.5 cu. ft. capacity, top load, SS basket, white).
3. GE - Dryer Model GTD42EASJWW (7.2 cu. ft. capacity, aluminized alloy drum, electric dryer, white).

2.4 ACCESSORIES

A. Provide rough-in hardware, supports and connections, attachment devices, closure trim, and accessories.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 73 00 - Execution: Verification of existing conditions before starting work.

B. Verify plumbing, electrical, and venting service connection requirements.

C. Verify supports and anchorage construction is correct and in required locations.

3.2 PREPARATION

A. Section 01 73 00 - Execution: Prepare field conditions and existing construction for installation of work of this section.

B. Prepare materials to be installed and equipment to be used during installation.

3.3 INSTALLATION

A. Section 01 73 00 - Execution: Related to installation of Work.

B. Installation is to comply with manufacturer's recommendations and building code requirements.

C. Insulate to prevent electrolysis between dissimilar metals.

D. Use anchoring devices appropriate for equipment and expected usage.

3.4 ADJUSTING

A. Section 01 73 00 - Execution: Starting, testing, adjusting, and balancing.

B. Adjust equipment and apparatus to ensure proper working order and conditions.

C. Remove and replace equipment creating excessive noise or vibration.

3.5 CLEANING

A. Section 01 73 00 - Execution and Section 01 77 00 - Closeout Procedures: Related to cleaning.

B. Remove masking or protective covering from stainless steel and other finished surfaces.

C. Wash and clean equipment.

D. Polish glass, plastic, hardware, accessories, fixtures, and fittings.

3.6 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 73 00 - Execution: Protecting installed construction.

B. Protect installed Work from damage.

END OF SECTION

Construction Documents 6/12/24

SECTION 11 40 00

FOOD SERVICE EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the contract including general and supplementary conditions and general requirements apply to the work specified in this section.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Plumbing: Refer to Division 22, including:
1. Rough-in piping for gas and water supply and waste lines.
2. Piping for supply and waste lines.
3. Traps, grease traps, line strainers, tail pieces, valves, stops, shut offs and miscellaneous fittings required for complete installation.
4. Final connections.
5. Indirect drains for sink compartments.

B. Mechanical: Refer to Division 23, including:
1. Roof mounted fans and connecting ductwork not shown as part of the kitchen equipment.
2. Final connections, including approved welded duct connections to hoods.

C. Electrical: Refer to Division 26, including:
1. Rough-in conduit, wiring, line and disconnect switches, safety cut-offs and fittings, control panels, fuses, boxes and fittings required for complete installation.
2. Final connections, including mounting and wiring of switches furnished as part of the food service equipment (unless otherwise indicated on the drawings).

1.3 WORK INCLUDED THIS SECTION:

A. Furnish and install all food service equipment as specified herein, including that which is reasonably inferred, with all related items necessary to complete work shown on contract drawings and/or required by these specifications.

B. Electrical Work:
1. Interwiring of food service equipment between components within equipment, such as heating elements, switches, thermostats, motors, etc., complete with junction box as is applicable, ready for final connection.
2. Voltages shall be as indicated on contract drawings. Any differences in electrical characteristics at job site from those shown on contract documents must be submitted to Architect for consideration prior to ordering equipment.

C. Plumbing Work:
1. Furnish all equipment with faucets, sink waste assemblies, and trim as specified in this section.
2. Other than sink compartments, extend all indirect waste lines to nearest floor receptor. All such drain lines to be properly sized. Drain shall terminate with proper air gap above flood rim of floor receptor. Drain lines to be copper with silver paint unless specified otherwise. Drain lines in public areas to be chrome plated where exposed to view.

1.4 QUALITY ASSURANCE

A. It is required that all custom fabricated equipment such as food serving units, tables, sinks, counter tops, etc., be manufactured by a food service equipment fabricator who has the plant, personnel and engineering equipment required. Such manufacturer shall be subject to approval of Architect. All work in above category shall be manufactured by one manufacturer and shall be of uniform design and finish.

B. Manufacturer of this equipment must be able to show that he is now and for the past five years has been engaged in manufacture or distribution of equipment, as required under this contract, as his principal product.

C. Manufacturer of equipment specified herein shall be a recognized distributor for items of equipment specified herein which are of other manufacture than his own.

D. Only manufacturers who can meet the foregoing qualifications will be acceptable.

E. All work shall be done in an approved workmanlike manner, to the complete satisfaction of the Owner.

1.5 SUBMITTALS

A. Submit shop drawings as required by General Conditions. All shop drawings and rough-in drawings shall be CAD drafted and must be submitted in .DWF or .PDF electronic format. Multiple hard copies are not acceptable.

B. Shop drawings and bound brochures covering manufactured or "buy-out" items covering all work and equipment included in this contract shall be submitted to Architect as soon as possible after award of contract. After approval, Food Service Equipment Contractor shall furnish to Architect electronic files of shop drawings and brochures, corrected as required by virtue of review comments, for distribution to various interested trades on project. All costs of reproduction and submission shall be part of contract.
Bound brochure and cut sheet submittals must be copied to Owner for review and comment.

C. Provide fully dimensioned rough-in plans at 1/4" scale, consisting of a separate drawing for each discipline. Each drawing shall show equipment shaded down 50%. Rough-in set shall include all required mechanical, electrical, plumbing, services for equipment and dimensioned rough-in location for same. Rough-in locations shown shall make allowances for required traps, switches, etc., thereby not requiring interpretation or adjustment on the part of other Contractors.
Drawings shall indicate dimensions for floor depressions, wall openings, etc., for equipment.
Food Service Equipment Contractor shall visit site to verify all rough-in and sleeve locations prior to installation of finished floors and shall cooperate with other Contractors involved in proper location of same. Food Service Equipment Contractor shall be responsible for any required relocations of rough-in due to errors or inaccuracies on those rough-in plans which he prepares.

D. Rough-in plans shall include all required services which relate to equipment, but which may not directly connect thereto, such as convenience outlets at walls, hose stations, floor drains, etc.

E. Rough-in plans shall also include all required outlet services for equipment which is designated on drawing schedule, even though such equipment may not be included in this contract.

F. Fully dimensioned and detailed shop drawings of custom fabricated equipment items shall be submitted, drawn at 3/4" and 1 - 1/2" scale for plans, elevations, and sections respectively.

Drawings shall show all details of construction, installation, and relation to adjoining and related

work where cutting or close fitting is required. Drawings shall show all reinforcements, anchorage, and other work required for complete installation of all fixtures.

G. Do not begin fabrication of custom manufactured equipment until approvals of shop drawings have been received and until field measurements have been taken by Food Service Equipment Contractor, where such measurements are necessary to assure proper conformance with intent of contract drawings and specifications.

H. Make field measurements, giving due consideration to any architectural, mechanical, or structural discrepancies which may occur during construction of building. No extra compensation will be allowed for any difference between actual measurements secured at job site and dimensions indicated on contract drawings. Any differences which may be found at job site during field measurements shall be submitted to Architect for consideration before proceeding with fabrication of equipment.

I. Submit illustrative brochures for manufactured or "buy-out" equipment items, complete with illustrations, specifications, line drawings, rough-in requirements, and list of accessories or other specified additional requirements. Brochures shall be bound and shall include data on all equipment which is to be provided, arranged in numerical sequence which conforms to item numbers of specifications. Omission of data does not reduce obligation to provide items as specified.

J. Approval of shop schedules and brochures will be in general and shall be understood to mean that Architect has no objection to use of materials or processes shown. Approval does not relieve Food Service Equipment Contractor from responsibility for errors, omissions, or deviations from contract requirements.

1.6 SUBSTITUTIONS - STANDARDS

A. Refer to Instructions to Bidders and Division 01 for requirements.

B. All unspecified substitutions after bid must be submitted to Owner for written approval prior to acceptance.

1.7 DRAWINGS

A. Drawings which constitute part of contract documents indicate general arrangement of piping and location of equipment. Should it be necessary to deviate from arrangement indicated in order to meet structural conditions, make such deviations without expense to Owner.

B. Specifications and drawings are reasonably exact, but their extreme accuracy is not guaranteed. Drawings and specifications are for assistance and guidance of Contractor, and exact locations, distances and levels shall be governed by the building.

1.8 MANUFACTURER'S DIRECTIONS

A. Follow manufacturer's directions in all cases where manufacturers of articles used in this contract furnish directions or prints covering points not shown on drawings or specifications.

1.9 INDUSTRY STANDARDS

A. Electric operated and/or heated equipment, fabricated or otherwise, shall conform to latest standards of National Electric Manufacturers Association and of Underwriters Laboratories, Inc., and shall bear the U.L. label.

B. Cooking and hot food holding equipment shall meet minimum construction standards as noted by NSF #4.

C. Refrigeration equipment shall meet minimum construction standards as noted by NSF #7.

D. Items of food service equipment furnished shall bear the N.S.F. seal.

E. Food service equipment shall be installed in accord with N.S.F. standards.

F. Work and materials shall be in compliance with requirements of applicable codes, ordinances and regulations, including but not limited to those of Occupational Safety and Health Act (OSHA), National Fire Protection Association, State Fire Marshal, State Accident Commission, U.S. Public Health Service, State Board of Health, local health codes, etc.

G. No extra charge will be paid for furnishing items required by regulations, even though such may not be shown on drawings or called for in these specifications.

H. Rulings and interpretations of enforcing agencies shall be considered part of regulations.

PART 2 - PRODUCTS

2.1 MANUFACTURED EQUIPMENT

A. All like types of equipment such as all refrigerated and heated cabinets, all ovens, and all mixers shall be by the same manufacturer.

B. Except as may be specified otherwise under individual item specifications in “Equipment Schedule", all items of standard manufactured equipment shall be complete in accord with manufacturer's standard specification for specific unit or model called for, including finishes, components, attachments, appurtenances, etc., except as follows:

C. All items of standard equipment shall be that manufacturer's latest model at time of delivery.

D. Substitutions for manufactured equipment specified will be accorded consideration under terms set forth in "Substitutions - Standards".

2.2 FABRICATED EQUIPMENT

A. Stainless steel shall be U.S. standard gauges as called for, 18-8, Type 302, or Type 304, No. 4 finish.

B. Galvanized iron shall be Armco or equal. Framework of galvanized iron shall be welded construction, having welds smooth, and where galvanizing has been burned off, touched up with high grade aluminum bronze.

C. Legs and crossrails shall be continuously welded, unless otherwise noted, and ground smooth.

D. Bottom of legs at floor shall be fitted with sanitary stainless-steel bullet type foot, with not less than 2" adjustment.

E. Legs shall be fastened to equipment as follows:
   1. To sinks by means of closed gussets. Gussets shall be stainless steel, reinforced with bushing, having set screws for securing legs.

   2. To tables and drainboards with closed gussets which shall be welded to stainless steel hat sections or channels, 14 gauge or heavier, exposed hat sections having closed ends. Bracing shall be welded to underside of tops.

F. Closed gussets shall be a 3" minimum diameter at top, continuously welded to frame members or to sink bottom.

G. Sinks, unless otherwise specified, shall be furnished with rotary type waste outlets, without connected overflows: Atlantic Brass Works Model 772-RB; Fisher Brass Foundry Model 250A; T&S; or approved equal. Where exposed, furnish wastes chromium plated.

H. Rolls shall be 1 1/2" diameter, except as detailed contrary, with corners bullnosed, ground and polished.

I. Seams and joints shall be shop welded. Welds to be ground smooth and polished to match original finish. Materials 18 gauge or heavier shall be welded.

J. Metal tops shall be one-piece welded construction, unless specified otherwise, reinforced on underside with stainless steel hat sections or channels welded in place. Crossbracing to be not more than 30" on centers.

K. Drawers to be 18-gauge stainless steel channel type housing and drawer cradle, both housing and cradle being reinforced and welded at corners, housing being secured to underside of table top, and both housing and cradle being sized for and fitted with 18-gauge 20" x 20" x 5" deep stainless-steel drawer insert having coved corners. Drawer insert shall be easily removable from cradle without tools or having to remove entire drawer. Drawers to have stainless steel fronts. Provide with recessed flush type stainless steel pulls.

L. Support drawer on fabricated 14- gauge stainless steel interlocking channel solid delrin ball bearing wheels. Support slides shall be load rated at 200 lb. per pair. Slides to be Component Hardware S52 Series.

M. Enclosed cabinet type bases shall be made of formed steel sheets reinforced with formed steel sections to create a rigid structure. Steel shall be 18-gauge or heavier. Base shall be welded construction throughout with front rails, mullions, etc., welded to appear as one-piece construction. All exposed sections of interior and exterior shall be stainless steel, and unexposed sections shall be galvanized steel, unless specified contrary.

N. Doors shall be double cased, unless otherwise noted. Outer pans shall be 18-gauge with corners welded, ground smooth, and polished. Inner pans shall be 20-gauge, fitted tightly into outer pan with sound-deadening material such as Celotex used as core. Two pans shall be tack-welded together with seam solder filled.

   Door shall finish approximately 3/4" thick and shall be fitted with flush recessed type stainless steel door pulls. Single pan type doors shall be reinforced and stiffened with closed hat sections.

O. Hinged doors shall be flush type mounted on heavy-duty stainless-steel piano or concealed hinges.

P. Hardware shall be solid materials and except where unexposed or specified contrary, of cast brass, chrome plated. Stampings are not acceptable. Identify all hardware with manufacturer's name and number so that broken or worn parts may be ordered and replaced.

Q. Fabricate sink compartments with fully coved vertical and horizontal corners. Multiple compartment partition to be double thickness, continuously welded where sheets join at top. Front of multiple compartment sinks to be continuous on exterior. Bottoms shall be creased to drain.

R. Ends of all fixtures, splashbacks, shelves, etc., shall be finished flush to walls or adjoining fixtures.

S. Dishtables, draintables, splashbacks and turned-up edges shall have radius bends in all horizontal and vertical corners, coved at intersections.

T. Rounded and coved corners or radius bends shall be 1/2" radius or longer.

U. Shelves in fixtures with enclosed bases shall be turned up on back and sides and feathered slightly to insure tight fit to enclosure panels. Bottom shelves shall be made for easy removal unless otherwise noted.

V. Undersides of tops to be coated with heavy-bodied resinous material compounded for permanent, non-flaking adhesion to metal, 1/8" thick, applied after reinforcing members have been installed, drying without dirt-catching crevices.

W. Metal components, unless specified or noted otherwise, to be the following gauges:

Counter and tabletops	14 ga. Stainless Steel
Wall shelves	16 ga. Stainless Steel
Pipe leg undershelves	16 ga. Stainless Steel
Drawer fronts	16 ga. Stainless Steel
Enclosed cabinet bases	18 ga. Stainless Steel
Sinks and drainboards	14 ga. Stainless Steel
Legs 1 - 5/8" diameter	16 ga. Stainless Steel
Doors (outer pan)	18 ga. Stainless Steel
Doors (inner pan)	20 ga. Stainless Steel

X. Products fabricated by Savannah Industrial Solutions, John Boos, Premier Stainless, Eagle Group, Advance Tabco, or approved equal, modified to comply with specifications, are acceptable.

2.3 HEATING EQUIPMENT

A. Wherever electric heating equipment or thermostat control for such equipment is specified, it shall be complete, and of the materials, size and rating specified within equipment item or details. All such equipment shall be designed and installed to be easily cleaned or to be easily removed for cleaning.

B. Electrical appliances or heating element circuits of 120 volts shall not exceed 1650 watts, unless specifically shown contrary.

2.4 SWITCHES AND CONTROLS

A. Food Service Equipment Contractor shall supply on each motor driven appliance or electrical heating unit suitable control switch of proper type in accord with Underwriter's Code.

B. All internal wiring for fabricated equipment items included, all electrical devices, wiring, controls,

switches, etc., built into or forming an integral part of these items shall be furnished and installed by Food Service Equipment Contractor in his factory or building site with all items complete to junction box for final connection to building lines by Electrical Contractor.

C. Provide standard 3-prong plugs to fit "U" slot grounding type receptacles, similar to No. 5262, for all equipment items powered by plugging into 110-120 volts, single phase AC. Also, provide suitable length 3-wire cord for equipment.

2.5 CONNECTION TERMINALS

A. All equipment shall be complete with connection terminals as standardized by equipment manufacturers, except where specified otherwise.

2.6 LOCKS

A. Fit all doors for reach-in refrigerated compartments with locking type latches. Provide master keys.

2.7 GAS EQUIPMENT

A. Equipment to be suitable for use with gas available at site, and to be furnished by F.S.E.C. with pressure regulators designed to work with incoming pressure.

2.8 GAS QUICK DISCONNECTS

A. Where specified, gas quick disconnects shall be furnished complete with gas valve, gas connector hose, quick disconnect fitting elbows, and restraining cable, all AGA approved. Gas hose shall be flexible, braided or corrugated stainless steel with smooth plastic exterior coating or sleeve of heat shrink tubing (provide on all caster mounted gas equipment).

B. All mobile cooking equipment requiring surface protection by fire suppression nozzles shall be secured in place by stainless steel cradle type wheel stops as manufactured by the Eagle Group or Select Stainless products. Plastic wheel stops are not acceptable.

PART 3 - EXECUTION

3.1 GENERAL

A. Work under this contract and covered under this section of specifications includes but is not limited to:
   1. Cutting of holes and/or ferrules on equipment for piping, drains, electrical outlets, conduits, etc. as required to coordinate installation of food service equipment with work of other Contractors on project.
   2. Field checking of building and rough-in requirements, and submission of brochures and shop drawings, all as required hereinbefore under "Submittals".
   3. Repair of all damage to premises as result of this installation, and removal of all debris left by those engaged in this installation.
   4. Having all food service equipment fixtures completely cleaned and ready for operation when building is turned over to Owner.

3.2 INSTALLATION PROCEDURES

A. Food Service Equipment Contractor shall make arrangements for receiving his custom fabricated

and "buy out" equipment and shall make delivery into building as requisitioned by his installation superintendent. He shall not consign any of his equipment to Owner or to any other Contractor unless he has written acceptance from them and has made satisfactory arrangements for the payment of all freight and handling charges.

B. Food Service Equipment Contractor shall deliver all custom fabricated and "buy out" equipment temporarily in its final location, permitting Trades to make necessary arrangements for connection of service lines; he shall then move equipment sufficiently to permit installation of service lines, after which he shall realign his equipment level and plumb, making final erection as shown on contract drawings.

C. All portable or counter mounted equipment weighing more than 25 pounds shall be mounted on 4" stainless steel adjustable legs.

D. This Contractor shall coordinate his work and cooperate with other trades working at site toward the orderly progress of the project.

E. Architect or Owner's Agent shall have access at all times to plant or shop in which custom fabricated equipment is being manufactured, from time contract is let until equipment is shipped, in order that progress of work can be checked, as well as any technical problem which may arise in coordination of equipment with building. Any approval given at this point of manufacture shall be tentative, subject to final inspection and test after complete installation.

F. Food Service Equipment Contractor shall assist Architect, Owner, and/or Owner's Agent in making any desired tests during or prior to final inspection of equipment; he shall remove immediately any work or equipment rejected by Architect, Owner, and/or Owner's Agent, replacing same with work conforming with contract requirements, and shall reimburse mechanical and/or other contractors involved for extra work made necessary by such replacement.

G. This Contractor shall keep premises free from accumulation of his waste material and rubbish, and at completion of his work shall remove his rubbish and implements, leaving areas of his work broom clean.

H. This Contractor shall provide and maintain coverings or other approved protection for finished surfaces and other parts of his equipment subject to damage during and after erection. After removal of protective coverings, all field joints shall be ground and polished, and entire work shall be thoroughly cleaned and polished.

3.3 TRIMMING AND SEALING EQUIPMENT

A. Seal completely spaces between all units to walls, ceilings, floors, and adjoining (not portable) units with enclosed bodies against entrance of food particles or vermin by means of trim strips, welding, soldering, or commercial joint material best suited to nature of equipment and adjoining surface material.

B. Close ends of all hollow sections.

C. Equipment butting against walls, ceilings, floor surfaces and corners to fit tightly against same; backsplashes or risers which fit against wall to be neatly scribed and sealed to wall with DowCorning # 732 RTV or General Electric clear silicone sealant, wiping excess sealant out of joint to fillet radius. Where required to prevent shifting of equipment and breaking wall seal, anchor item to floor or wall.

D. Treat enclosed spaces (inaccessible after equipment installation) for vermin prevention in accord with industry practice.

3.4 TESTING AND DEMONSTRATION OF EQUIPMENT

A. After completion of installation, all equipment using water, gas, and electricity shall be performance inspected and tested by factory certified service agent, including wet test of hood fire suppression systems, if so required. Food Service Equipment Contractor shall document that these inspections have been performed prior to scheduling demonstrations and Owner acceptance of equipment.

B. Food Service Equipment Contractor shall arrange to have all manufactured, mechanically operated equipment furnished under this contract demonstrated by authorized representatives of equipment manufacturers, these representatives to instruct Owner's designated personnel in use, care and maintenance of all items of equipment after same are in working order. Demonstration and instruction shall be held on dates designated by Owner.

C. Food Service Equipment Contractor shall provide a competent service representative to be present when installation is put into operation.

3.5 EQUIPMENT HANDLING AND STORAGE

A. Deliver equipment to site, properly crated and protected, and store in safe place, protected from damage until time for installation.

3.6 GUARANTEE

A. Special Project Warranty: Provide written warranty, signed by manufacturer, agreeing to replace/repair, within warranty period, with inadequate and defective materials and workmanship, including leakage, breakage, improper assembly, or failure to perform as required, provided manufacturer's instructions for handling, installing, protecting, and maintaining units have been adhered to during warranty period. This warranty shall be in addition to, and not limitation of, the rights the Owner may have against the Contractor under the Contract Documents.

B. Warranty Period:
1 year from date of Substantial Completion, all new equipment furnished. However, manufacturer’s warranty shall prevail when the period is longer than one year.
5-year warranty period on refrigeration compressors.
10-year warranty period on walk-in panels.

3.7 OPERATING AND MAINTENANCE MANUALS

A. After completion of installation, Food Service Equipment Contractor shall present to Owner three sets of all operating and maintenance manuals, covering all mechanically operated equipment furnished under this contract, each set being neatly bound in looseleaf binder having durable cover.

B. Include in each binder a list of names, addresses and telephone numbers of local servicing agencies authorized to make necessary repairs and/or adjustments of equipment furnished under this contract.

4.0 EQUIPMENT SCHEDULE

ITEM 01 AIR CURTAIN QUANTITY AS SCHEDULED

Provide air curtain with the following features:
A. For 72" wide door
B. Unheated
C. Galvanized steel cabinet
D. Obsidian black powder coat finish
E. Voltage as scheduled, direct connection
F. Microswitch at door
Air curtain to be as manufactured by Mars Air Systems, Model No. LPN272-1UA-OB, Curtron, or Berner.

ITEM 02A SHELVING UNIT, POLY-WIRE QUANTITY AS SCHEDULED

Provide wire shelving unit with the following features:
A. Arrange using quantities and sizes as shown on plan drawings.
B. 800 lb. capacity per shelf
C. 2000 lb. capacity per unit
D. (5) Quick-adjust shelves with removable polymer open-grid shelf mats and epoxy-coated one-piece steel frames
E. (4) Polymer posts
F. Antimicrobial product protection
Shelving unit to be as manufactured by Metro, Model No. 5Q457G3.

ITEM 02B SHELVING UNIT, POLY-WIRE QUANTITY AS SCHEDULED

Provide wire shelving unit with the following features:
A. Arrange using quantities and sizes as shown on plan drawings.
B. 600 lb. capacity per shelf
C. 2000 lb. capacity per unit
D. (5) Quick-adjust shelves with removable polymer open-grid shelf mats and epoxy-coated one-piece steel frames
E. (4) Polymer posts
F. Antimicrobial product protection
Shelving unit to be as manufactured by Metro, Model No. 5Q467G3.

ITEM 03 COLD STORAGE ASSEMBLY QUANTITY AS SCHEDULED

Provide pre-fabricated cold storage room assembly of size and shape shown on plan and detail drawings. Exact overall size to be field verified prior to fabrication.
A. Insulation:
Panels shall be insulated with 4" thick urethane, foamed or poured in place using HCPC (no CFC) blowing agent. Foam shall be 2.25 lb. density, 95% closed cell. Panels shall meet STME-84 (UL-723) and be listed by Underwriters laboratories. Panels shall have a maximum flame spread of 25, maximum smoke developed of 450 minimum. Flash ignition of 600 degrees and minimum self-ignition of 800 degrees F.
B. Coved corners:
Assembly shall be constructed so that all interior wall, floor and ceiling intersections shall comply with N.S.F. requirements.
C. Cam lock fasteners:
All panel intersections and wall, floor and ceiling intersections shall be secured by cam lock fasteners connected with 2" wide metal straps set in and completely surrounded by insulation.
D. Finishes:

Exterior and interior finishes shall be as shown on drawings.

E. Doors:
Door size and finish shall be as shown on drawings, and shall be furnished complete with sill wiper gasket, and a minimum of 3 spring loaded lift type hinges. Doors to be Super doors with a reinforced 14 ga. U-Channel steel frame, backed with additional 1/8" steel plate drilled and tapped where all hardware is mounted. 3/16" backing on all doors larger than 42" wide.
Exterior door to be equipped with automatic door closer.
Cooler and Freezer doors to be equipped with perimeter heat.
All doors to be equipped with heavy duty padlocking pull-handle lever, with inside safety release.

F. Thermometers:
Each compartment to be provided with exterior flush mounted thermometer mounted at eye level to each door. Provide remote read-out for freezer compartment at exterior cooler door.

G. Lights:
Each compartment to be furnished complete with manufacturer's standard light fixtures, having protective cover, mounted and pre-wired to switch with pilot light in door section. Extra light fixtures as needed to provide 30-foot candles 30" above floor. Lights to be furnished and installed by this section.

H. Ceiling panels to be one piece, self-supporting and span full width of assembly when available.

I. Floor:
Recessed floor by F.S.E.C. with .100 diamond tread aluminum.
Reinforced floor panels to support minimum 1200 pounds per square foot.
The floor and ceiling shall have maximum length panels to span full length of box, if possible, otherwise stagger joints so there are no common "four corner" intersections and no joints occur ring in doorways.

J. Refrigeration System:
Shall be furnished by manufacturer as part of cold storage room assembly, provide each compartment with complete refrigeration system sized to maintain appropriate temperature.
Provide temperature alarm system with remote read-out and recording capability. Condensing units to be air-cooled, remote. Units to have performance and wiring characteristics as scheduled on drawings. Refrigeration systems to be designed for use with R448 refrigerant. Condensing units to be provided with painted galvanized steel all-weather housing, controls, and crankcase heaters, all suitable for outdoor conditions, and located as shown on drawings. Evaporators to be low-silhouette type with adaptive defrost control equal to a Bally SmartVap+controller. Evaporators to be equipped with 2speed EC motors, running full speed while refrigeration is engaged, and running at 1/3 speed while system is pumped down; mounted at locations shown on drawings. Performance and wiring characteristics to be as scheduled on drawings. Condensing units shall be provided with 2 speed EC fan motors, running full speed while refrigeration is engaged and 1/2" speed while ambient temp is below 60 degrees Fahrenheit. Also, the crank case heater will be turned off at an ambient above 60 degrees Fahrenheit.
Evaporator drain lines to be provided by this section and extended to floor receptors outside assembly.
Freezer drain lines to be wrapped with heater cable and insulated with pre-molded foamed plastic insulation suitable for the application. Thickness as recommended by manufacturer.
Refrigerant piping to be ACR copper tubing, hard temper, with wrought fittings and silver solder joints. Insulate suction lines with pre-molded foamed plastic insulation, thickness as recommended by manufacturer for temperature and application.
Refrigeration systems to be provided with all required refrigerant piping, insulation, sight glass vibration eliminator, solenoid(s), dryer, suction line filter, expansion valve(s), thermostat(s), heat exchangers, and defrost timers, etc. as necessary for complete installation. Provide pump down control circuit consisting of thermostat and solenoid valve. All components including piping and insulation to be installed using accepted industry standards, manufacturer's instructions and first-class workmanship.

K. Miscellaneous:

Assembly to be installed on depressed building slab. See detail drawing.
Provide 1/8" diamond tread wainscot along exposed front exterior of assembly mounted from floor to 48" A.F.F.
Provide trim strips, closure panels, etc., as necessary to trim assembly to adjacent building surfaces.
Provide removable top closure panels with "C" channel rails. Lift-out panel sections to have turn-down edges for strength and are not to exceed 4'-0" in length.
Provide plastic strip curtains at door locations, transparent vinyl overlapping strips, aluminum bar hanging rod and bracket, suitable for low temperature application, as manufactured by Curtron, Flexstrip Products, Inc., or equal. Size to suit openings.
Provide heated pressure relief port in freezer.
Provide sleeves properly located for utility entrance, drain lines, and refrigeration lines, and after lines are installed, fill sleeves with spray foam compound, suitable for use in refrigerated spaces. Trim excess foam away and cover with stainless steel escutcheon.
Cold storage room shall be erected by factory trained, or factory approved installers or shall be supervised by factory personnel. Refrigeration systems shall be furnished by cold storage room manufacturer and installed by factory approved personnel. Shop drawing submittal shall indicate who the installer is, and a letter of approval shall accompany the submittal indicating the manufacturer's acceptance of the installers.
This specification does not constitute a complete description of cold storage assembly, also see plan and detail drawings.

Cold storage room assembly to be as manufactured by Bally, Thermo-Kool, American Panel, Imperial/Brown, or Masterbilt complying with specifications and drawings.

ITEM 04A SHELVING UNIT, POLY-WIRE QUANTITY AS SCHEDULED

Provide wire shelving unit with the following features:
A. Arrange using quantities and sizes as shown on plan drawings.
B. 800 lb. capacity per shelf
C. 2000 lb. capacity per unit
D. (4) Quick-adjust shelves with removable polymer open-grid shelf mats and epoxy-coated one-piece steel frames
E. (4) Polymer posts
F. Antimicrobial product protection

Shelving unit to be as manufactured by Metro, Model No. Q446G3.

ITEM 04B SHELVING UNIT, POLY-WIRE QUANTITY AS SCHEDULED

Provide wire shelving unit with the following features:
A. Arrange using quantities and sizes as shown on plan drawings.
B. 800 lb. capacity per shelf
C. 2000 lb. capacity per unit
D. (4) Quick-adjust shelves with removable polymer open-grid shelf mats and epoxy-coated one-piece steel frames
E. (4) Polymer posts
F. Antimicrobial product protection

Shelving unit to be as manufactured by Metro, Model No. Q456G3.

ITEM 04C SHELVING UNIT, POLY-WIRE QUANTITY AS SCHEDULED

Provide wire shelving unit with the following features:
A. Arrange using quantities and sizes as shown on plan drawings.
B. 600 lb. capacity per shelf

C. 2000 lb. capacity per unit
D. (4) Quick-adjust shelves with removable polymer open-grid shelf mats and epoxy-coated one-piece steel frames
E. (4) Polymer posts
F. Antimicrobial product protection

Shelving unit to be as manufactured by Metro, Model No. Q466G3.

ITEM 05A DUNNAGE RACK QUANTITY AS SCHEDULED

Provide dunnage rack with the following features:
A. 22" x 36" x 12"H
B. Slotted
C. With separate polymer tie for joining racks
D. Corrosion proof polymer construction
E. Antimicrobial product protection

Dunnage rack to be as manufactured by Metro, Model No. HP2236PDMB, Cambro, or Eagle Group.

ITEM 05B DUNNAGE RACK QUANTITY AS SCHEDULED

Provide dunnage rack with the following features:
A. 22" x 48" x 12"H
B. Slotted
C. With separate polymer tie for joining racks
D. Corrosion proof polymer construction
E. Antimicrobial product protection

Dunnage rack to be as manufactured by Metro, Model No. HP2248PDMB, Cambro, or Eagle Group.

ITEM 06 CAN RACK QUANTITY AS SCHEDULED

Provide can rack with the following features:
A. First In/First Out Can Storage Rack, stationary.
B. 25-1/2"W x 42-1/4"D x 82"H.
C. Front loading.
D. Holds (156) #10 cans.
E. Inclined angle can slides.
F. Welded aluminum construction.

Can rack to be as manufactured by Channel, Model CSR-156, Piper, or Quantum.

ITEM 07 NOT USED

ITEM 08 REACH-IN REFRIGERATOR QUANTITY AS SCHEDULED

Provide reach-in refrigerator with the following features:
A. Two-section
B. Nom. 50” wide
C. Minimum capacity of 40 cu. ft.
D. Self-contained bottom mounted refrigeration
E. (2) Full-height solid hinged self-closing field reversible doors (locking)
F. (6) Epoxy coated wire shelves
G. Height adjustable clips
H. Digital controls with LED display
I. Auto defrost
J. LED interior lighting

K. Stainless steel interior, stainless steel front & sides, galvanized steel top, bottom & rear
L. (2) Leg stabilizers
M. (4) 5" Swivel casters (2 locking)
N. Voltage as scheduled, cord and plug

Reach-in refrigerator to be as manufactured by Everest Refrigeration, Model No. EBSR2, Continental, or Beverage Air.

ITEM 09 ONE (1) COMPARTMENT SINK QUANTITY AS SCHEDULED

Provide one-compartment sink having the following features:
A. 54-3/16"W x 25-1/2"D x 44-1/16"H overall size
B. (1) 20"W x 20" front-to-back x 14" deep compartment, lever drain
C. (1) 30" Left drainboard
D. 10"H boxed backsplash with 45° top & 2" return
E. (1) Set of splash mount faucet holes with 8" centers
F. 3-1/2" Die-stamped drain opening
G. 14/300 Stainless steel construction
H. Stainless steel legs, adjustable front & side bracing, adjustable bullet feet
I. Pre-rinse unit

One-compartment sink to be as manufactured by John Boos, Model 41PB204-1D30L, Advance Tabco, or Aero.

ITEM 10 FOOD PROCESSOR, BENCHTOP QUANTITY AS SCHEDULED

Provide food processor with the following features:
A. Includes: vegetable prep attachment with kidney shaped & cylindrical hopper (no bowl)
B. (1) 3MM grating disc
C. (1) 3mm slicing disc
D. Polycarbonate base
E. Single speed 425 RP
F. Voltage as scheduled, cord and plug

Food processor to be as manufactured by Robot Coupe, Model No. CL50E, Univex, or Globe.

ITEM 11 WORK TABLE, S/S TOP QUANTITY AS SCHEDULED

Provide work table with the following features:
A. 96"W x 30"D
B. 16/300 Stainless steel flat top
C. With Stallion Safety Edge front & back
D. 90° Turndown on sides
E. Galvanized legs, side & rear adjustable bracing
F. Adjustable bullet feet
G. HD Drawers
H. Table mounted pot rack, as shown

Work table to be as manufactured by John Boos, Model No. ST6-3096GBK-X, Advance Tabco, or Aero.

ITEM 12 TWO (2) COMPARTMENT SINK QUANTITY AS SCHEDULED

Provide two-compartment sink with drainboards as follows:
A. Provide two compartment sink with the following features:
B. 91-1/4"W x 25-1/2"D x 44-1/16"H Overall size
C. (2) 20"W x 20" Front-to-back x 14" deep compartments, lever waste(s)
D. (2) 24" Left & right drainboards

E. 10"H boxed backsplash with 45° top and 2" return
F. (1) Set of splash mount faucet holes with 8" centers
G. 3-1/2" Die-stamped drain opening
H. 14/300 Stainless steel construction, stainless steel legs
I. Adjustable front & side bracing, adjustable bullet feet
J. T&S Brass 5PR-8W12 pre-rinse unit

Two-compartment sink to be as manufactured by John Boos, Model 42PB1824-2D24, Advance Tabco, or Aero.

ITEM 12.1 OVERSHELF QUANTITY AS SCHEDULED

Provide overshelf with the following features:
A. 36"W x 12"D x 9-1/2"H overall size
B. Wall mounted
C. 1-1/2" Rear upturn, safety edge front
D. 14/300 Stainless steel

Sorting shelf to be as manufactured by John Boos, Model No. BHS1236-14/304, Advance Tabco, or Aero.

ITEM 13-16 NOT USED

ITEM 17 HAND SINK QUANTITY AS SCHEDULED

Provide hand sink with the following features:
A. Wall mount
B. 12"W x 14-1/2"D x 12-1/4"H overall size
C. 9"W x 9" front-to-back x 5" deep bowl
D. Splash mount faucet holes with 4" centers
E. 2" Drain opening with basket drain
F. With left & right side splashes
G. Stainless steel construction
H. Splash mount faucet
I. P-trap, 1-½" & tail pipe

Hand sink to be as manufactured by John Boos, Model No. PBHS-W-0909-P-SSLR, Advance Tabco, or Aero.

ITEM 18 NOT USED

ITEM 19 PASS-THRU HEATED CABINET QUANTITY AS SCHEDULED

Provide pass-thru heated cabinet with the following features:
A. Pass-Thru
B. One-section
C. 21.5 Cu. ft. capacity
D. (2) Half-height solid hinged doors, (2) half-height glass hinged doors on kitchen side
E. (3) Silver freeze (chrome-style) shelves
F. Standard depth cabinet
G. Exterior digital control system
H. Cylinder locks
I. Stainless steel exterior, aluminum interior
J. Legs, set of 4, 6" high adjustable stainless steel
K. Voltage as scheduled, cord and plug

Pass-thru heated cabinet to be as manufactured by Victory Refrigeration, Model HSA-1D-S1-PT-HD,

Piper, or Continental.

ITEM 20 PASS-THRU REFRIGERATOR QUANTITY AS SCHEDULED

Provide pass-thru refrigerator with the following features:
A. Pass-thru
B. One-section
C. Self-contained refrigeration
D. 23.7 Cu. ft. capacity
E. (2) Half-height solid hinged doors, (2) half-height glass hinged doors on kitchen side
F. (3) Silver freeze (chrome-style) shelves
G. Stainless exterior, aluminum interior
H. Standard depth cabinet
I. Electronic temperature control/indicator
J. LED lighting
K. Expansion valve technology
L. Door gaskets with 2-year warranty
M. Stainless steel breakers
N. Pan slides(pr), for (2)12"x20" pans
O. Legs, set of 4, 6" high adjustable stainless steel, standard
P. Voltage as scheduled, cord and plug
Pass-thru refrigerator to be as manufactured by Victory Refrigeration, Model RSA-1D-S1-PT-HD-HC, Beverage Air, or Continental.

ITEM 21 ICE MAKER, CUBE-STYLE QUANTITY AS SCHEDULED

Provide ice maker with the following features:
A. Cube style
B. Air-cooled
C. Self-contained condenser
D. Production capacity up to 758 lb/24 hours at 70°/50°
E. Medium cube size
F. Mobile app, Bluetooth
G. Preservation mode
H. External bin full indicator
I. Alert indicating lights
J. Water sensing adjustable purge control
K. One-touch cleaning, harvest assist
L. Front facing removable air filters
M. Unit specific QR code
N. Stainless steel finish, antimicrobial protection
O. Bin top
P. Water filter
Q. Backflow preventer
R. Voltage as scheduled, direct connection
Ice machine to be as manufactured by Scotsman, Model No. MC0722MA-32, Ice-O-Matic, or Hoshizaki.

ITEM 21.1 ICE BIN QUANTITY AS SCHEDULED

Provide ice bin with the following features:
A. Top-hinged front-opening door
B. 536 Lb. application capacity
C. For top-mounted ice maker

D. 30" Width
E. Rotocast plastic construction
F. Toolless removable baffle
G. Polyurethane insulation, polyethylene liner
H. Includes 6" legs

Ice bin to be as manufactured by Scotsman, Model No. B530P, Ice-O-Matic, or Hoshizaki.

ITEM 22 FIRE SUPPRESSION SYSTEM QUANTITY AS SCHEDULED

Provide automatic wet chemical fire suppression system as required to protect exhaust hood, Item 23 and 65, and the cooking equipment located under this hood, and having the following features:

A. All tanks, control heads, piping, relays, cable, fusible links, nozzles, elbows, etc., as required for complete system
B. Brass nozzles and chrome plated or sleeved exposed piping
C. Manual strike mechanism in accessible location
D. Installation in accord with N.F.P.A. 17A code requirements and coordinate with exhaust hood construction and installation
E. Four contacts for use by E.C., one contact for alarm, one for supply fan shut-off, one for shunt trip actuation, and one spare
F. Provide mechanical gas solenoid valve loose for installation by plumber

Fire suppression system to be as manufactured by Ansul, Model R-102, Pyro-chem, or Range Guard.

ITEM 23 EXHAUST HOOD QUANTITY AS SCHEDULED

Provide dual wall mount canopy exhaust hood of size, shape and content as shown on detail drawings, having the following features:

A. All exposed surfaces of 18-gauge 430 Series, 18-8 stainless steel construction
B. N.F.P.A. 96 construction, including all joints and seams welded externally, continuous, and liquid tight
C. 5/8" diameter hanger rods to structural ceiling, approximately 96" on center
D. Stainless steel high-efficiency baffle type U.L. classified grease extracting filters, with handles
E. Integral grease gutter sloped to drain to grease receptacle
F. Vapor-proof U.L. listed recessed LED light fixtures
G. Coordinated installation of fire suppression system as specified for Item 22
H. Integral make-up air plenum along front as shown
I Provide spacer frame to allow passage of utility chase between hood sections and stainless-steel trim on bottom and ends
J. Removable stainless steel perimeter trim and/or closure panels from top of hood to ceiling
K. Food Service Equipment Contractor shall provide and install any secondary supporting members required to suspend exhaust hoods. Hood supports shall include seismic bracing, if required, installed in accord with SMACNA guidelines
L. Fire suppression cabinet with pre-wire control package and switches with variable speed control fan.

Exhaust hood to be as manufactured by Captive-Aire, Model ND2-PSP, Gaylord, or Avtec.

ITEM 24 CONVECTION STEAMER, GAS QUANTITY AS SCHEDULED

Provide convection steamer having the following features:

A. Gas heated, natural
B. Boilerless
C. Double stacked
D. On ES26304066G equipment stand
E. (6) Full size pan capacity

F. 60-Minute electro-mechanical timer & manual (continuous steaming) bypass switch
G. Left-hand hinged door, controls on right
H. Automatic drain & water level controls
I. Clean shield interior
J. Standard treated & tap water connection
K. Stainless steel exterior
L. 4" Adjustable legs with flanged feet
M. Voltage as scheduled, cord and plug
N. Water filter, back flow preventer
O. 60” Quick gas disconnect, with 5’ FDA approved hose thread

Convection steamer to be as manufactured by Cleveland, Model No. (2) 22CGT66.1, Accu-Temp, or Groen.

ITEM 25 HD RANGE, 24” QUANTITY AS SCHEDULED

Provide heavy duty range with the following features:
A. Gas heated, natural
B. 24"
C. (4) 12" 30,000 BTU open burners
D. Oven interior 16-1/4" W x 28-1/4" D x 14-3/4" H
E. Stainless steel front, black sides
F. 4" Back flue riser
G. 6" High adjustable legs
H. 140,000 BTU
I. 1-1/4" Front manifold without pressure regulator
J. S/S Backguard, 12"Wx24"H
K. Quick gas disconnect

Gas range to be as manufactured by Montague Company Model No. 124-5, Southbend, or Imperial.

ITEM 26 CONVECTION OVEN, GAS QUANTITY AS SCHEDULED

Provide convection oven with the following features:
A. Gas heated, natural
B. Double-deck, standard depth
C. Capacity (5) 18" x 26" pans per compartment
D. Solid state infinite controls with 60 min. manual timer
E. Two speed fan
F. Porcelainized baking compartment
G. Dependent glass doors
H. Interior light
I. Flue connector
J. Stainless steel front, sides & top
K. Low profile casters
L. 48” Flexible gas hose with quick disconnect & restraining device
M. Voltage as scheduled, cord and plug

Convection oven to be as manufactured by Blodgett, Model No. ZEPH-100-G-ES DBL, Southbend, or Vulcan.

ITEM 27 TILTING SKILLET BRAISING PAN QUANTITY AS SCHEDULED

Provide gas tilting braising pan with the following features:
A. Gas heated, natural
B. 30-gallon capacity

C. 9.5" deep skillet pan with etched gallon markings
D. Open leg frame base, flanged feet
E. Standard with manual tilt mechanism
F. Spring assist cover
G. Stainless steel pan and frame
H. Pilot ignition
I. Voltage as scheduled, cord and plug
J. Single pantry faucet
K. Draw off valve kit, 2” tangent

Tilting braising pan to be as manufactured by Market Forge, Model 30P-STGL, Cleveland, or Vulcan.

ITEM 28 FLOOR TROUGH QUANTITY AS SCHEDULED

Provide floor trough having the following features:
A. Anti-Spill Floor Trough, 36"W x 18"D x 6" deep
B. (1) 4" OD tailpiece
C. Stainless-steel beehive strainer
D. 14/304 stainless-steel, brushed satin finish
E. (PFG) pultruded fiberglass grating

Floor trough to be IMC Teddy, Model ASFT-1836-PFG, Premier Stainless, or Eagle Group.

ITEM 29 FOOD SLICER, ELECTRIC QUANTITY AS SCHEDULED

Provide food slicer with the following features:
A. Manual, 13" knife
B. Med duty
C. Angle feed
D. No volt release, poly-v belt drive
E. Permanent ring guard
F. Removable anodized aluminum carriage & knife cover
G. Top mounted sharpener
H. Anodized aluminum finish
I. Voltage as scheduled, cord and plug
J. Equipment stand, with undershelf

Slicer to be as manufactured by Hobart, Model EDGE13-11, Globe, or Univex.

ITEM 30 HEATED HOLDING CABINET QUANTITY AS SCHEDULED

Provide controlled humidity heated cabinet having the following features:
A. Mobile
B. Full height
C. 6.8" Touch-screen controls
D. Clear double panel tempered glass dutch doors
E. Universal wire slides
F. Capacity (17) 18" x 26" or (34) 12" x 20" x 2-1/2" pans
G. 3" O.C. (adjustable on 1-1/2" increments)
H. Stainless steel
I. 5" Casters
J. Polymer bumper & drip trough combination
K. Voltage as scheduled, cord and plug

Heated cabinet to be as manufactured by Metro, Model C599-SDC-U, Alto-Shaam, or Piper.

ITEM 31 THREE (3) COMPARTMENT SINK QUANTITY AS SCHEDULED

Provide three-compartment sink having the following features:
A. 123-1/4"W x 33-1/2"D overall size
B. (3) 20"W x 28" front-to-back x 14" deep compartments, (3) lever wastes
C. (2) 30" Left & right drainboards
D. 10"H boxed backsplash with 45° top and 2" return
E. (1) Set of splash mount faucet holes with 8" centers
F. 3-1/2" Die-stamped drain opening
G. 14/300 Stainless steel construction
H. Stainless steel legs, adjustable front & side bracing, adjustable bullet feet
I. Modified overflow hole, centered
J. T&S Brass 5PR-8W12 pre-rinse unit, with add-on faucet
K. T&S Brass B-0231 wall mount faucet
Sink to be as manufactured by John Boos, Model 43PB20284-2D30, Advance Tabco, or Aero.

ITEM 31.1 OVERSHELF QUANTITY AS SCHEDULED

Provide overshelf with the following features:
A. Wall-mounted
B. 144"W x 12"D
C. 18/430 Stainless steel shelf
D. 2" x 1/4" Stainless steel pot rack
E. Includes: (9) plated double pot hooks
Overshelf to be as manufactured by Advance Tabco, Model PS-12-144, John Boos, or Aero

ITEMS 32-35 NOT USED

ITEM 36 DRYING RACK UNIT QUANTITY AS SCHEDULED

Provide drying rack unit with the following features:
A. 48"W x 24"D x 68"H
B. 4-Tier
C. (2) Open shelf frames
D. (4) 63" Mobile posts
E. (2) Drop-ins
F. (1) Cutting board/tray drying rack
G. (4) Polymer swivel casters (2 with brakes)
H. Antimicrobial product protection
Drying rack unit to be as manufactured by Metro, Model No. PR48VX3, or Cambro.

ITEM 37 CAN OPENER QUANTITY AS SCHEDULED

Provide can opener with the following features:
A. Manual
B. With stainless steel base
C. For cans up to 16" tall
D. Rust proof
Can opener to be as manufactured by Edlund, Model No. S-11, or approved equal.

ITEM 38 UNIVERSAL PAN RACK QUANTITY AS SCHEDULED

Provide universal pan rack with the following features:
A. 25.5"W x 25.5"D x 69"H
B. Aluminum construction

D. 1.5" Angle spacing
E. (13) Pans and trays of varying widths
F. 5" Swivel plate casters

Universal pan rack to be as manufactured by Channel Manufacturing, Model No. AUR-13, Piper, Eagle Group, or Metro.

ITEM 39 SHELVING UNIT QUANTITY AS SCHEDULED

Provide wire shelving unit with the following features:
A. 48"W x 24"D x 67-5/16"H
B. (4) Open grid shelves with epoxy coated steel frames & removable polymer shelf mats
C. (4) Polymer posts
D. Antimicrobial product protection
E. (4) Swivel 5" casters with polyurethane treads (2 braked)

Shelving unit to be as manufactured by Metro, Model No. Q556EG3.

ITEM 40 MILK COOLER QUANTITY AS SCHEDULED

Provide milk cooler with the following features:
A. 34” Long
B. Dual access
C. Forced air cooling
D. (8) 13”x13”x11” or (4) 19”x13”x11” Crate capacity
E. Door cylinder security locks
F. Electronic control with digital display, hi-low alarm, hi-low temperature alarm
G. S/S interior and exterior
H. Floor drain
I. 5” swivel casters
J. Voltage as scheduled, cord and plug

Milk cooler to be as manufactured by Continental, Model No. MC3NSSD, Beverage Air, or Delfield.

ITEM 41 SERVING LINE COUNTER MILLWORK

Custom Millwork Serving Counter to be fabricated in accordance with plan and detail drawings. Field verify all requirements.

ITEM 42 HOT/COLD SHELF QUANTITY AS SCHEDULED

Provide hot/cold shelf with the following features:
A. Drop-in ceramic glass shelf
B. Two-tier
C. 31-1/4"W x 25-1/4"D
D. Solid state digital controls
E. On/off rocker switch
F. Voltage as scheduled, cord and plug

Hot/cold shelf to be as manufactured by Low Temp Industries, Model QSGT-28-2T, Duke, or Piper.

ITEM 43 HOT/COLD FOOD WELL QUANTITY AS SCHEDULED

Provide hot/cold food well with the following features:
A. Drop-in food well
B 49-1/2"W x 26-3/4"D x 21-16/25”H
C. 14ga S/S top and wells

D. (3) 12”x20” Pan size
E. Wired remote
F. Individual wired remote digital controls
G. Manifold drain
H. Galvanized exterior
I. Voltage as scheduled, cord and plug

Hot/cold food well to be as manufactured by Low Temp Industries, Model DI-QSCHP-3, Duke, or Piper.

ITEM 44 HOT/COLD FOOD WELL QUANTITY AS SCHEDULED

Provide hot/cold food well with the following features:
A. Drop-in food well
B 34-1/4"W x 26-3/4"D x 21-16/25”H
C. 14ga S/S top and wells
D. (2) 12”x20” Pan size
E. Wired remote
F. Individual wired remote digital controls
G. Manifold drain
H. Galvanized exterior
I. Voltage as scheduled, cord and plug

Hot/cold food well to be as manufactured by Low Temp Industries, Model DI-QSCHP-2, Duke, or Piper.

ITEM 45 SNEEZE GUARD, STATIONARY QUANTITY AS SCHEDULED

Provide adjustable sneeze guard with the following features:
A. Single sided double guard
B. Two-tiered with top shelf
C. Tempered glass with polished edges
D. Adjustable end panels
E. Table mount
F. 1" OD round stainless support posts
G. Ultra-slim LED display light
H. Voltage as scheduled, cord and plug
I. Sneeze guard section sizes and content as shown on plan and detailed drawings

Sneeze guard to be as manufactured by Premier Metal & Glass, Model No. TM2R-A, Hatco, or BSI.

ITEM 46 DROP-IN MERCHANDISER QUANTITY AS SCHEDULED

Provide drop-in refrigerated merchandiser with the following features:
A. 43-1/2"W x 24"D x 50"H
B. Pass-thru
C. Self-contained refrigeration
D. 18/304 Stainless steel top
E. Self-closing sliding doors on customer & operator side
F. (2) Adjustable plastic-coated wire shelves
G. Fluorescent lighting with separate on/off switch
H. Forced air evaporator
I. Internal thermometer
J. 20/304 Stainless steel double-wall construction for interior & exterior
K. Door locking device
L. Voltage as scheduled, cord and plug

Drop-in merchandiser to be as manufactured by Atlas, Metal Model No. WCPT-3, Duke, or Piper.

ITEM 47 REFRIGERATED CASE (FUTURE) N.I.K.C.

ITEM 48 P.O.S. N.I.K.C.

This item is to be furnished by Owner.

ITEMS 49-50 NOT USED

ITEM 51 HAND SINK QUANTITY AS SCHEDULED

Provide hand sink with the following features:
A. Wall mount
B. 12"W x 14-1/2"D x 12-1/4"H overall size
C. 9"W x 9" front-to-back x 5" deep bowl
D. Splash mount faucet holes with 4" centers
E. 2" Drain opening with basket drain
F. With left & right side splashes
G. Stainless steel construction
H. Splash mount faucet
I. P-trap, 1-½" & tail pipe
Hand sink to be as manufactured by John Boos, Model No. PBHS-W-0909-P-SSLR, Advance Tabco, or Aero.

ITEM 52 ICE MAKER WITH BIN, CUBE STYLE QUANTITY AS SCHEDULED

Provide undercounter ice maker with the following features:
A. Cube style
B. Air cooled
C. 20" Width
D. Contained condenser
E. Production capacity up to 100 lb/24 hours at 70°/50° (80 lb AHRI certified at 90°/70°)
F. 57 lb Bin storage capacity
G. Clear medium cube
H. Horizontal evaporator
I. ADA compliant with floor mount kit
J. No side clearance required
K. Unit specific QR code
L. 6" Legs included
M. Ice scoop included
N. R-134a Refrigerant
O. Water filter
P. Backflow preventer
Q. Voltage as scheduled, cord and plug
Ice maker to be as manufactured by Scotsman, Model No. CU0920MA-1, Ice-O-Matic, or Manitowoc.

ITEM 53 REACH-IN REFRIGERATOR QUANTITY AS SCHEDULED

Provide reach-in refrigerator with the following features:
A. One-section
B. 27” wide
C. 21 cu. ft.
D. Self-contained bottom mounted refrigeration, R290 hydrocarbon refrigerant
E. (1) Full-height solid hinged self-closing field reversible door

F. (3) Epoxy coated wire shelves, height adjustable clips
G. Digital controls with LED display
H. Auto defrost
I. LED interior lighting
J. Stainless steel interior, stainless steel front & sides, galvanized steel top, bottom & rear
K. (2) Leg stabilizers
L. (4) 5" Swivel casters (2 locking)
M. Voltage as scheduled, cord and plug

Reach-in refrigerator to be as manufactured by Everest Refrigeration, Model No. EBR1, Beverage Air, or Continental.

ITEM 54 THREE-COMPARTMENT SINK QUANTITY AS SCHEDULED

Provide three-compartment sink with the following features:
A. 12" Right & left drainboards
B. Bowl size 14" x 16" x 12" deep, lever drain
C. 18-Gauge 304 stainless steel
D. Tile edge splash, rolled edge
E. 8" OC faucet holes
F. Galvanized legs with 1" adjustable plastic bullet feet
G. HD splash mount faucet, 12” swing, with wrist handles

Three-compartment sink to be as manufactured by Advance Tabco, Model No. FE-3-1416-12RL-X, John Boos, or Aero.

ITEM 55 MICROWAVE OVEN QUANTITY AS SCHEDULED

Provide microwave oven with the following features:
A. 1.2 Cu. ft.
B. 1800 Watts
C. Medium volume
D. 4-Stage cooking
E. (5) Power levels
F. (100) Memory settings
G. 60-Minute max cooking time
H. LED display
I. Touch control
J. ADA-compliant Braille touch pads
K. Audible end of cycle signal
L. Side hinged door with tempered glass
M. Lighted interior
N. Sealed and recessed ceramic shelf
O. Stainless steel exterior & interior
P. Voltage as scheduled, cord and plug

Microwave oven to be as manufactured by ACP, Model No. RFS18TS, Sharp, or Panasonic.

ITEM 56 HEATED WELL QUANTITY AS SCHEDULED

Provide countertop food cooker with the following features:
A. Electric, countertop
B. (1) 11 Qt. round pan capacity
C. Dry operation
D. Thermostatic controls
E. 122° - 212°F

F. Includes pan
G. RHW-11QT-LID-HG lid, hinged
H. Stainless steel construction
I. Voltage as scheduled, cord and plug

Countertop food warmer to be as manufactured by Hatco, Model No. RHW-1, Vollrath, or APW Wyott.

ITEM 57 P.O.S. N.I.K.C.

This item is to be furnished by Owner.

ITEM 58 CONCESSIONS COUNTER MILLWORK

Custom Millwork Serving Counter Assembly to be fabricated in accordance with plan and detail drawings. Field verify all requirements.

END OF SECTION 114000

Construction Documents 6/12/24

SECTION 11 53 00
LABORATORY EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Corrosives and acids storage cabinets.
   2. Flammables storage cabinets.
   3. Laboratory refrigeration units.
   4. Accessories.

1.2 REFERENCES

A. Environmental Protection Agency (EPA).

B. Factory Mutual (FM).

C. International Code Council (ICC) - International Fire Code (IFC):
   1. ICC I-CODE IFC - International Fire Code; 2021.

D. National Fire Protection Association (NFPA):
   1. NFPA 1 - Fire Code; 2021, Errata 2022.
   2. NFPA 30 - Flammable and Combustible Liquids Code; 2024.

E. Underwriters Laboratories Inc. (UL):
   1. UL (Dir) - Online Certification Directory; Current Edition.

F. US Department of Labor - Occupational Safety and Health Act (OSHA).

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Section 01 30 00 - Administrative Requirements: Requirements for coordination.
   2. Coordinate requirements of this Section with any utilities, alarms, or grounding connection requirements that may be required.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data and drawings indicating compliance with product specifications Regulatory Requirements indicated in this Section.

C. Manufacturer's Installation Instructions: Indicate special installation criteria and interface with adjacent components.

1.5 QUALIFICATIONS

A. Manufacturer Qualifications: Company specializing in manufacturing Products specified in this Section with minimum five (5) years documented experience.

B. Installer Qualifications: Company specializing in performing work of this Section and with minimum three (3) years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Deliver products in manufacturer's original packaging. Store materials in a dry, protected, well-vented area. Inspect product upon receipt and report damaged material immediately to delivering carrier and note such damage on the carrier's freight bill of lading.

1.7 WARRANTY

A. Section 01 77 00 - Closeout Procedures: Product warranties.

B. Manufacturer's Warranty: Provide manufacturer's standard ten (10) year warranty for materials and workmanship to be free of defects. Warranty duration to begin with the date of Substantial Completion.

PART 2 PRODUCTS

2.1 CORROSIVES AND ACIDS STORAGE CABINETS

A. Regulatory Requirements:
   1. Comply with approvals and requirements of FM, UL, OSHA, NFPA 1, NFPA 30, ICC I-CODE IFC, EPA, and authorities having jurisdiction.

B. Manufacturers:
   1. Durham Manufacturing.
   2. Global Industrial.
   3. Justrite.
   4. Labconco.
   5. Substitutions: Section 01 60 00 - Product Requirements.

C. Basis of Design: Justrite - Sure-Grip EX Safety Storage Cabinet.

D. Storage Cabinet Types:
   1. Acid Storage Cabinet:
      a. Size and Capacity:
         1) 65 H x 24 W x 18 D inches. 22 gallons (83 L) capacity.
      b. Color: As selected by Architect from manufacturer's full range.
   2. Base Storage Cabinet:
      a. Size and Capacity:
         1) 65 H x 24 W x 18 D inches. 22 gallons (83 L) capacity.
      b. Color: As selected by Architect from manufacturer's full range.

E. Cabinet:
   1. Double wall construction; 18 gauge steel.
   2. Leakproof seals.
   3. Comply with EPA requirements for leakproof spills sump, and not less than 2 inches.
   4. Dual vents.
   5. Grounding wire connection.
   6. Leveling feet.

F. Cabinet Doors:
   1. Double wall construction; 18 gauge steel.
   2. Single door for cabinet width of 24 inches or less. Double doors for cabinet width greater than 24 inches.
   3. Door hinges to be secured to frame at cabinet side panels.

4. Self-closing doors shut and latch automatically when a fusible link melts at 165° F (74° C) under fire conditions. Self-closing mechanism is to allow obstruction-free access to contents. Coordinated self-closing for double doors.
5. Three-point self-latching doors.
6. Door Latch: Recessed with perimeter flange; paddle type pull latch release; lockable cylinder with keys; secondary security lock feature for padlock use.
7. Factory apply warning labels indicating type of contents and labels as may be required in compliance with Regulatory Requirements.

G. Shelves: Adjustable locations with adjustable mount brackets.
1. One adjustable shelf for each 18 inches of cabinet overall height.
2. Shelves designed with slight slope to rear allowing minor spills to drain from rear of shelf to bottom spills sump.
3. Polyethylene trays attached to galvanized steel shelves and a separate polyethylene liner for the bottom sump, resistant to aggressive chemicals. Liner is to be easily removed for cleaning of drips and leaks.
4. Provide extra polyethylene work tray that can be secured to cabinet top for a handy work surface.

H. Fabrication:
1. Fabricate components free of distortion and defects.
2. Corners and joints to be fully welded and finished prior to application of finish.

I. Finishes:
1. Epoxy powder coat finish on interior and exterior cabinet surfaces.

2.2 FLAMMABLES STORAGE CABINETS

A. Regulatory Requirements:
1. Comply with approvals and requirements of FM, UL, OSHA, NFPA 1, NFPA 30, ICC I-CODE IFC, EPA, and authorities having jurisdiction.

B. Manufacturers:
1. Durham Manufacturing.
2. Global Industrial.
3. Justrite.
4. Labconco.
5. Substitutions: Section 01 60 00 - Product Requirements.

C. Basis of Design: Justrite - Sure-Grip EX Safety Storage Cabinet.

D. Flammable Storage Cabinet:
1. Size and Capacity:
   a. 65 H x 24 W x 18 D inches. 22 gallons (83 L) capacity.
2. Color: Yellow.
3. Double wall construction; 18 gauge steel.
4. Leakproof seals.
5. Comply with EPA requirements for leakproof spills sump, and not less than 2 inches.
6. Dual vents with flame arresters.
7. Grounding wire connection.
8. Leveling feet.

E. Cabinet Doors:
1. Double wall construction; 18 gauge steel.
2. Single door for cabinet width of 24 inches or less. Double doors for cabinet width greater than 24 inches.
3. Door hinges to be secured to frame at cabinet side panels.

4. Self-closing doors shut and latch automatically when a fusible link melts at 165° F (74º C) under fire conditions. Self-closing mechanism is to allow obstruction-free access to contents. Coordinated self-closing for double doors.
5. Three-point self-latching doors.
6. Door Latch: Recessed with perimeter flange; paddle type pull latch release; lockable cylinder with keys; secondary security lock feature for padlock use.
7. Factory apply warning labels indicating type of contents and labels as may be required in compliance with Regulatory Requirements.

F. Shelves: Adjustable locations with adjustable mount brackets.
1. One adjustable shelf for each 18 inches of cabinet overall height.
2. Shelves designed with slight slope to rear allowing minor spills to drain from rear of shelf to bottom spills sump.
3. Galvanized steel shelves.

G. Fabrication:
1. Fabricate components free of distortion and defects.
2. Corners and joints to be fully welded and finished prior to application of finish.

H. Finishes:
1. Epoxy powder coat finish on interior and exterior cabinet surfaces.

2.3 LABORATORY REFRIGERATION UNITS

A. Manufacturers:
1. Labcold.
2. Liebherr.
3. Thermo Scientific.
4. Substitutions: Section 01 60 00 - Product Requirements.

B. Refrigerator/Freezer Units.
1. Basis of Design:
   a. Liebherr - LCexv 4010.
2. Vertical standing unit with lockable self-closing doors to each refrigerator and freezer compartments.
3. Spark-free interior compartments.
4. Volume Capacity:
   a. Refrigerator Capacity: Minimum 200 L (7.0 cu ft).
   b. Freezer Capacity: Minimum 50 L (1.76 cu ft).
5. Locations: As indicated on Drawings.

2.4 ACCESSORIES

A. Goggles Storage Cabinet:
1. Basis of Design: Sellstrom - S90494 Germicidal Cabinet.
2. Germicidal goggles and safety glasses sanitizing cabinet.
3. Temperature Range: 0 to 40 degrees C. Maximum relative humidity 80 percent for temperatures up to 31 degrees C, decreasing linearly to 50 percent relative humidity at 40 degrees C.
4. Listed UL (DIR).
5. Electrical: 120V, 60hz; integrated 10 amp fuse protection against electrical overload.
6. Controller: Automatic 5 minute timer control.
7. Cabinet: 22 gauge steel; surface mounted type; white baked enamel.
8. Goggle Racks: 8 shelf racks; 0.187 steel wire; white baked enamel.
9. Capacity: 40 googles.
10. Lock: Stainless steel; vandal-resistant; keyed to laboratory casework master key.

B. Fire Blanket and Cabinet:
   1. Basis of Design:
      a. Larsen - FB 1016 Series, standard cabinet (16W x 10H x 8D inches).
   2. Cabinet: 22 gauge steel; surface mounted type; red baked enamel.
   3. Blanket: 62 x 80 inches; wool and complying with 16 CFR 1610.

C. Wall Hooks: Wall mounted upper and lower pronged hook for lab coats and other articles.
   1. Basis of Design: Spectrum Plastics, Ltd. - Toughook.
   2. Coordination: Provide concealed solid blocking at wall locations for mounting hooks.
   3. Material: Molded nylon-plastic; vandal resistant; unbreakable.
   4. Size and Shape: Curved design with hook at top and at bottom.
      a. 16W x 120H x 32D millimeters (0.63W x 4.73H x 1.25D inches).
   5. Mounting: Each hook to be wall mounted with 2 screws through screw holes formed during manufacturing process. Holes to be countersunk for recessing screw heads. Provide stainless steel screws of length required to securely anchor hoods through substrate and into structure or blocking behind substrate.
   6. Color: To be selected by Architect from manufacturer's full range.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 73 00 - Execution: Verification of existing conditions before starting work.

B. Verify that field measurements are as required.

C. Verify that surfaces and conditions are ready to accept the Work of this Section.

D. Examine products to be installed for damage and other conditions detrimental to completion of the Work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Section 01 73 00 - Execution: Prepare field conditions and existing construction for installation of Work of this Section.

B. Prepare materials to be installed and equipment to be used during installation.

3.3 INSTALLATION

A. Section 01 73 00 - Execution: Related to installation of Work.

B. Install equipment in compliance with the design requirements, regulatory requirements, and manufacturer's recommendations.

C. Install equipment plumb and level.

D. Anchor equipment securely in place.

E. For equipment requires utilities, alarms, or grounding connections, apply connections securely.

3.4 ADJUSTING

A. Section 01 73 00 - Execution: Starting, testing, adjusting, and balancing.

B. Adjust operating components to smooth operation without binding.

3.5 CLEANING

A. Section 01 73 00 - Execution and Section 01 77 00 - Closeout Procedures.

B. Clean installed Work in accordance with manufacturer's recommendations including cleaning procedures and materials.

3.6 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 73 00 - Execution: Protecting installed construction.

B. Protect installed construction from damage and unauthorized tampering.

3.7 DEMONSTRATION AND TRAINING

A. Section 01 79 00 - Demonstration and Training: Provide demonstration and training to Owner regarding operation and maintenance of the Work of this Section.

END OF SECTION

SECTION 11 53 13
LABORATORY FUME HOODS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes laboratory fume hoods and accessories.

B. Related Sections:
1. Division 22 - Plumbing Fixtures: Final connection of laboratory sinks.
2. Division 23 - Ductwork: Final connections to fume hoods.
3. Division 26 - Electrical: Final connections for electrical requirement.

1.2 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

B. Coordinate the Work with plumbing, mechanical, and electrical connections.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings: Include component dimensions, configurations, elevations, cross sections, construction details, and connections to countertops.

C. Product Data: Submit information type, size, finish, accessories for each fume hood specified.

D. Provide validation of all required certification and testing as listed in Part 2.

E. Manufacturer’s Installation Instructions: Submit special precautions for installation.

1.4 QUALITY ASSURANCE

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories, Inc., as suitable for purpose specified and indicated.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in the manufacture of products specified in this Section with minimum three (3) years documented experience.

B. Installer: Company specializing in installing the work of this Section with three (3) years documented experience and approved by the Manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Store units in protected area and in accordance with manufacturer's recommendations.

PART 2 PRODUCTS

2.1 FUME HOODS

A. Manufacturers:
1. Fisher Scientific.

2. Kewaunee Scientific Equipment Corporation.
3. Labconco Corporation.
4. Mott Manufacturing Ltd.
5. Multilab.
6. Sheldon Laboratory Systems.
7. Substitutions: Section 01 60 00 - Product Requirements.

B. Basis of Design:
1. Labconco Basic 70 Model: 2246400.
a. Dimensions: 70W x 25D x 48H inches.

2.2 COMPONENTS

A. Bench-Type Hoods: Comply with ADA requirements and conform to the following:
1. Type: Constant volume/bypass air flow system.
2. Construction: Double wall steel with back panel.
3. Length:
a. 70 inches.
4. Exhaust:
a. 1,120 cfm.
5. Finish Coating: Epoxy powder coat finish.
6. Sash Type: Vertical rising, counterbalanced movements; glass to be fully tempered safety type, 3/16 inch thick minimum.
a. One vertical rising sash on one side of fume hood unit.
7. Baffle:
a. Adjustable type.
8. Electrical Characteristics: 115 volt AC, 60 Hz.
9. Lighting: To be UL listed.
a. Explosion proof for explosion proof hood units; Vapor proof for vapor proof hood units.
10. Accessories:
a. Two duplex 120 volt AC receptacles; UL listed.
b. Airflow monitoring device and alarm.
c. Remote blower located outside the building envelope.
d. Exhaust ductwork to be stainless steel.

B. Fume hoods are to function as ventilated, enclosed workspaces, designed to capture, confine, and exhaust fumes, vapors and particulate matter produced or generated within the enclosure.

C. Design fume hoods for consistent and safe air flow through the hood face. Negative variations of face velocity are not to exceed 20 percent of the average face velocity at any designated measuring point as defined in this section.

D. Work Area Illumination: Minimum 80 footcandles. Work area is defined as the area inside the superstructure from side to side and from face of baffle to the inside face of the sash, and from the working surface to a height of 28 inches.

E. Design fume hoods to minimize static pressure loss with adequate slot area and bell shaped exhaust collar configuration. Maximum average static pressure loss readings shall not exceed the following maximum when reading are taken three diameters above the hood outlet from four points, 90 degrees apart:
1. Fume hood is to maintain constant exhaust volume at any baffle position for safety. Maximum variation in exhaust CFM, static pressure, and average face velocity as a result of baffle adjustment shall not exceed 5 percent for any baffle position at the specified face velocity.

F. Fume Hoods are to be Certified and Labeled as a unit with the following:
   1. UL 1805
   2. SEFA 1-02
   3. ASHRAE 110 - 95
   4. ANSI Z9.5-93

G. Design fume hoods to comply with ADA requirements and to be ergonomically correct.

H. Fume hoods are not to be assembled using exposed screws or fasteners inside holding the liner or outside holding the louvers or grilles.

I. Fume Hood Liner: Flame Spread: 15 or less per U.L. 723 and ASTM E84 80.
   1. 16-gauge cold-rolled steel; smooth finish and bright white color in final appearance.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 73 00 - Execution: Verification of existing conditions before starting work.

B. Verify that field measurements, required utilities, and related construction elements are as required for installation.

C. Verify that surfaces and conditions are ready to accept the work of this Section.

D. Examine products to be installed for damage and other conditions detrimental to completion of the Work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Section 01 73 00 - Execution: Prepare field conditions and existing construction for installation of work of this Section.

B. Prepare materials to be installed and equipment to be used during installation.

3.3 INSTALLATION

A. Section 01 73 00 - Execution: Related to installation of Work.

B. Install the work in compliance with the design requirements, applicable codes, manufacturer's recommendations, and the contract documents.

C. Install units plumb and level.

D. Install accessories and coordinate trades in making connections to utilities.

3.4 ADJUSTING

A. Section 01 73 00 - Execution: Starting, testing, adjusting, and balancing.

B. Adjust hardware, controls, and operating components to function smoothly.

C. Adjust operating doors for smooth and balanced movement.

3.5 CLEANING

A. Section 01 73 00 - Execution and Section 01 77 00 - Closeout Procedures.

B. Clean installed work in accordance with manufacturer’s recommendations including cleaning procedures and materials.

C. Clean surfaces soiled by work as recommended by manufacturer of soiled substrate.

3.6 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 73 00 - Execution: Protecting installed construction.

B. Protect the Work from damage.

3.7 DEMONSTRATION AND TRAINING

A. Section 01 79 00 - Demonstration and Training.

B. Provide demonstration and training to the Owner regarding operation and maintenance of the Work of this Section.

END OF SECTION

SECTION 11 66 23
GYMNASIUM EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Scorer's Table.
2. Gymnasium Floor Cover.
3. Ball Storage Cage.
4. Team Chairs.

1.2 REFERENCES

A. ASTM International (ASTM):
1. ASTM D2261 - Standard Test Method for Tearing Strength of Fabrics by the Tongue (Single Rip) Procedure (Constant-Rate-of-Extension Tensile Testing Machine); 2013, Editorial Changes 2017.
2. ASTM D5034 - Standard Test Method for Breaking Strength and Elongation of Textile Fabrics (Grab Test):2021.

B. National Electric Code (NEC):
1. NEC Article 600 - Current Edition.

C. National Fire Protection Association (NFPA):
1. NFPA 701 - Standard Methods Of Fire Tests For Flame Propagation Of Textiles And Films; 2023.

D. Underwriters Laboratories Inc. (UL):
1. UL (DIR) - Online Certification Directory; Current Edition.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data describing product construction, sizes, configurations, jointing methods and locations, and functional components.

C. Shop Drawings: Submit shop drawings including profiles, components, materials, accessories, joint/seam fabrication and locations, and installed use location/layout.
1. Scorer's Table: Include details for folding/locking mechanism, caster type/sizes/quantities/locations, front signage panel attachment to table assembly, electrical requirements.
2. Gymnasium Floor Protective Cover: Include plan indicating cover layout and fabric edge overlap locations. Include details of roller storage racks and quantities required for storage of all fabric rolls.

D. Samples for Initial Selection: Two manufacturer's color charts illustrating the full range of finishes and colors available for products with factory-applied color finishes; submit for Architect's initial selections.

E. Samples for Verification: From the Architect's initial selections, prepare and submit two samples for each selected finish and color; samples on same product material type indicated for final Work; each sample 4 x 4 inches. Where finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 77 00 - Closeout Procedures.

B. Operation Data: Include description of equipment operation and required adjusting and testing.

C. Maintenance Data: Identify system maintenance requirements, parts list, servicing cycles, lubrication types required and local spare part sources.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this Section with minimum five (5) years documented experience.

B. Installer Qualifications: Company specializing in performing work of this Section and with minimum five (5) years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Deliver products in manufacturer's original packaging. Store materials in a dry, protected, well-vented area. Inspect product upon receipt and report damaged material immediately to delivering carrier and note such damage on the carrier's freight bill of lading.

1.7 WARRANTY

A. Section 01 77 00 - Closeout Procedures: Product warranties.

B. Warranty durations are to begin on the date of Substantial Completion.

C. Scorer's Table:
   1. Manufacturer's Warranty: Provide manufacturer's five (5) year warranty for materials and workmanship to be free of defects. Should a component or material fail to perform its function in normal use within this period, manufacturer is to provide matching repair or new replacement at no charge.

D. Gym Floor Protective Cover and Storage Rack:
   1. Manufacturer's Warranty: Provide manufacturer's warranty for materials and workmanship to be free of defects. Should a component or material fail to perform its function in normal use within this period, manufacturer is to provide matching repair or new replacement at no charge.
      a. Floor Covers: Warranty duration to be as follows.
         1) Weight of 18 - 21 oz/sq yd: Eight (8) years warranty duration.
      b. Floor Cover Storage Racks: Twenty (20) years warranty duration.

E. Ball Storage Cage: Provide manufacturer's standard warranty for materials and workmanship to be free of defects.

F. Team Chairs: Provide manufacturer's standard warranty for materials and workmanship to be free of defects.
   1. Team Chairs: Manufacturer's standard duration but not less than one (1) year.
   2. Team Chair Storage Carts: Manufacturer's standard duration but not less than one (1) year.

1.8 SPARE PARTS AND MAINTENANCE PRODUCTS

A. Section 01 60 00 - Product Requirements: Extra materials, spare parts, and maintenance products.

B. Scorer's Table: Furnish 3 spare lamps for the back-lit front panel sign.

C. Gymnasium Floor Cover.
1. Floor Cover Fabric: Provide 10 percent spare.
2. Floor Cover Storage Racks:
a. Hand Cranks: Provide 2 spares.
b. Electric Power Winder: Provide 1 spare.
c. Roller Tube: Provide 1 spare (include 4 cover attachment clips).

PART 2 PRODUCTS

2.1 SCORER'S TABLE

A. Manufacturers:
1. Sideline Interactive, LLC.
2. Substitutions: Section 01 60 00 - Product Requirements.

B. Basis of Design: Sideline Interactive, LLC - Backlit Static Table.

C. Scorer's Table: Designed for interior use and as follows:
1. Electrical components to be certified, listed, and labeled by the following standards organization(s) as suitable for the purpose indicated and installed conditions:
a. UL (DIR).
b. NEC Article 600.
2. Electrical components to include electrical surge protection.
3. Capable of withstanding strikes by balls and players.
4. Free-standing unit, transportable, and with heavy-duty locking non-marring swivel casters.
a. Capable of folding for transport.
5. Protective padding to be heavy-duty vinyl covered and secured to unit.
a. Color to be selected by Architect from manufacturer's full range.
6. Table Length:
a. 10 feet.
7. Front Panel Signage: Sign to be factory printed with custom graphics.
a. Single panel; full panel static graphics with electric back light illumination.
1) Sized to length and height of table.
2) Custom graphics design to be provided by the Architect.
3) Shatterproof polycarbonate sheet protective cover.
4) Maintenance access panel.
8. Finishes and Colors:
a. To be selected by the Architect from manufacturer's full range.
b. Metal components to be powder coat finish.
9. Electrical Power Strip: Integral power strip and media wire tray.

2.2 GYMNASIUM FLOOR COVER

A. Manufacturers:
1. CoverSports, a division of Humphrys.
2. CoverMaster.
3. Greatmats.
4. Substitutions: Section 01 60 00 - Product Requirements.

B. Basis of Design:
1. CoverSports - GymGuard Gym Floor Cover.

C. Gymnasium Floor Cover: Protective floor cover designed for interior use and as follows:

1. Physical Characteristics: Minimum requirements; comply with indicated standard.
   a. Weight: 18 oz/sq yd, minimum.
      1) 4 oz woven polyester fabric coated with 14 oz PVC (7 oz each side).
      2) Tensile Strength: 280 lbs x 270 lbs (ASTM D5034).
      3) Tear Strength: 90 lbs x 65 lbs (ASTM D2261).
      4) Surface Finish: Smooth surface.
2. Waterproof, rot and mildew resistant, anti-fungal, and anti-bacterial.
3. Color to be selected by Architect from manufacturer's full range.
4. Fire Resistance: Comply with NFPA 701 (large scale), and requirements of local authorities having jurisdiction.
5. Slip Resistant Surface: Comply with ADA and OSHA requirements.
6. Seams to be heat weld sealed, minimum 1 inch wide, and are to lay smooth and flat.
7. Roll Widths:
   a. 10 feet wide minimum.
8. Locations: Provide floor cover quantity for floor areas indicated.
   a. Gymnasium.
      1) Entire floor area, less area under extended bleachers.

D. Floor Cover Storage Racks: Engineered and designed to store multiple fully loaded floor cover rolls; mobile and stable base to deploy and load floor covers; allows for safe cover deployment by 2 persons.
1. Quantity: Provide quantity of storage rack units as required to store required floor cover quantity.
2. Storage Rollers:
   a. 8 rollers per each storage rack unit.
3. Size: Not to exceed 35 inches wide x 68 inches long x 79 inches high.
4. Frame: Steel framing and stabilizing members with powder coat finish.
5. Outriggers: Designed to stabilize storage rack during operational use; retractable with adjustable casters to prevent tipping; safety orange color.
6. Brakes: Floor locking brakes to be at each end of storage rack.
7. Casters: Lockable heavy-duty swivel casters; non-maintenance bearings for swivel and wheels; non-marring 3/4 inch tread thickness; 3 casters at each end.
8. Roller Collars: Bright yellow collar on each end of every roller to eliminate finger pinching.
9. Roller Brackets: Made of polycarbonate with delrin bearings. Mounted with 1/8 inch thick shock absorbing rubber pads.
10. Roller Safety: Safety bolt on each bracket to prevent roller “pop-ups”.
11. Rollers: Non-corrosive tube; protective coated for clean handling.
12. Fastening Clips: 4 push-on clips for each roller to secure floor cover sheet to roller.
13. Hand Cranks: 2 cranks designed to engage both roller ends for loading floor covers.
14. Accessories:
   a. Electric Power Winder: Provide one (1) hand-held electric power winder designed to engage roller end for loading floor covers; include reverse rotation switch.
   b. Floor Cover Brush Cleaner: Provide for each floor cover storage rack. Full width brush system designed to attach to the floor cover storage rack, Sweeps and cleans the floor cover on both sides simultaneously as each floor cover is cranked back (loaded) onto the rack rollers. Designed with two opposing sets of brush heads, each with a row of soft bristles of styrene fiber for fine particles and a row of stiffer polystyrene bristles for heavier debris.
   c. Storage Rack Cover: Provide one (1) for each floor cover storage rack. Designed to fully cover loaded and stored storage rack; material to be not less than 18 oz vinyl.

d. Seaming Tape: Provide quantity required for Owner to deploy full coverage of floor cover for six (6) separate events. Extra strength, clear, 3 inches wide, and formulated for easy removal and leaving no glue residue on floor or floor cover.
e. Seaming Tape Dispensers:
1) Walk-Behind Tape Dispenser: Provide one (1), designed to apply 3 inch wide floor cover seaming tape by user walking behind dispenser in fully erect walking posture. Unit to include tape roll dispenser cradle designed for easy tape roll changeover, flat roller for compressing dispensed tape to application surface, and in-line secondar guide wheel. Handle to be adjustable to user's height. Constructed of heavy gauge steel and enameled or powder coated finished.
2) Hand-Held Tape Dispenser: Provide two (2), designed to apply 3 inch wide floor cover seaming tape by user. Heavy-duty components; heavy gauge steel frame; ergonomically designed handle that won't twist under pressure during use.

2.3 BALL STORAGE CAGES

A. Manufacturers:
1. Gared Holding, LLC.
2. Substitutions: Section 01 60 00 - Product Requirements.

B. Basis of Design:
1. Gared - DBC Deluxe Ball Gage.

C. Ball Storage Cage: Provide two (2) storage cage units of the following minimum requirements.
1. Size: Overall unit to be 42 inches long x 24 inches wide x 42 inches high (from floor to top of frame's push handle.
a. Ball cage shape to be 42 inches long x 24 inches wide x 28 inches high.
2. Construction: Frame to be 1 inch steel tube framing. Ball cage to be 3/16 inch steel wire welded to form 3 inch square grid sections. Cage top to be hinged and lockable.
3. Finish and Color: Factory applied.
a. Powder coat; black color.
4. Casters: Provide four (4) swivel casters; each caster with single 3 inch diameter wheel and non-marring tread of 1/2 inch thickness.

2.4 TEAM CHAIRS

A. Team Chairs: Folding type with cushioned seat and backrest.
1. Quantity: Provide thirty-three (33) chairs.
2. Manufacturers:
a. Spec Seats.
b. Substitutions: Section 01 60 00 - Product Requirements.
3. Basis of Design:
a. Spec Seats - Model DS100 Logo Series.
4. Physical Characteristics:
a. Metal Frame: 18ga Galvanized Steel (DTC X-Frame)
b. Seat: Upholstered with 2.5 to 3 inch cushion thickness.
c. Backrest: Upholstered with 1 inch cushion thickness.
d. Front Leg: "K" brace with cross-brace.
e. Linking Bracket: 11 gauge steel.
f. Leg Foot: Non-marring molded metal foot inserts.
g. Chair Weight: 20 lbs (9.1 kgs).
h. Frame Height: 33 inches, open; 40 inches, closed.

i. Frame Width: 18.25 inches, includes ganging.
j. Seat Height: 19.25 inches, from floor to top of seat.
k. Depth: 22 inches, front to back.
l. Folded Thickness: 4.5 inches.

5. Finishes:
   a. Metal surfaces to be factory applied powder coat finish.
   b. Seat and backrest to be factory applied upholstery.
6. Colors: To be selected by Architect from manufacturer's full range.
7. Graphics: Custom graphics, factory applied to each chair.
   a. Separate graphics for seat cushion and seat backrest.
   b. Graphics design to be provided by Architect.
8. Accessories:
   a. Team Chair Storage Carts: Platform type storage cart.
      1) Quantity: Provide quantity of storage carts required to store quantity of chairs indicated.
      2) Basis of Design:
         a) Spec Seats - Model TSC106 (6 feet long, 4 casters).
      3) Size: 70 inches long x 36 inches wide x 82.5 inches high (88 inches high when loaded with folded chairs).
      4) Construction: Steel members designed and assembled to withstand loads imposed when cart is fully loaded and mobile. Cart structure to remain rigid and without racking during mobile use.
         a) Provide each end of cart with rigid U-shaped handle tubing for pushing and pulling cart from either end.
         b) Provide intermediate U-shaped tubing with adjustable location along length of cart. This member is to function as an adjustable "bookend" stop for chairs when cart is partially loaded.
      5) Casters: Lockable heavy-duty swivel casters; non-maintenance bearings for swivel and wheels; non-marring 3/4 inch tread thickness.
         a) Minimum 4 casters for carts of length 8 feet or less.
         b) Minimum 6 casters for carts longer than 8 feet and up to 10 feet.
            (1) 2 of the 6 casters are to be located at carts mid-length.
      6) Finish and Color: Factory applied powder coat; black color.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 73 00 - Execution: Verification of existing conditions before starting work.

B. Verify that field measurements are as required.

C. Verify that surfaces and conditions are ready to accept the Work of this Section.

D. Examine products to be installed for damage and other conditions detrimental to completion of the Work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Section 01 73 00 - Execution: Prepare field conditions and existing construction for installation of Work of this Section.

B. Prepare materials to be installed and equipment to be used during installation.

3.3 INSTALLATION

A. Section 01 73 00 - Execution: Related to installation of Work.

B. Products Requiring Installation: Install system components and accessories in accordance with manufacturer's printed instructions.

C. Products Normally Stored Until Use: Assemble system components and verify functionality prior to demonstration to Owner.

3.4 ADJUSTING

A. Section 01 73 00 - Execution: Starting, testing, adjusting, and balancing.

B. Adjust operating components to smooth operation without binding.

3.5 CLEANING

A. Section 01 73 00 - Execution and Section 01 77 00 - Closeout Procedures.

B. Clean installed Work in accordance with manufacturer’s recommendations including cleaning procedures and materials.

3.6 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 73 00 - Execution: Protecting installed construction.

B. Protect installed construction from damage and unauthorized tampering.

3.7 DEMONSTRATION AND TRAINING

A. Section 01 79 00 - Demonstration and Training.

B. Provide demonstration and training to Owner regarding operation and maintenance of the Work of this Section.

END OF SECTION

Construction Documents 6/12/24

SECTION 11 66 23.16

BASKETBALL BACKSTOPS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Indoor suspended backstops.

B. Related Requirements:
   1. Section - 05 12 00 - Structural Steel.
   2. Section - 05 21 00 - Steel Joists.
   3. Section - 05 50 00 - Metal Fabrications: Supplementary framing.
   4. Division 26 - Electrical: Electrical service for winch operations and Work requirement for electrical work.

1.2 REFERENCES

A. American Society of Civil Engineers (ASCE):
   1. 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 International (ASTM):
   1. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

C. American Welding Society (AWS):
   1. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020; Errata 2022.

D. Athletic Associates:
   1. National Association of Intercollegiate Athletics (NAIA).
   2. National Basketball Association (NBA).
   3. National Collegiate Athletic Association (NCAA).
   4. National Federation of State High School Associations (NFHS):
      a. NFHS - Basketball Rules Book; Current Edition.
   5. International Basketball Federation (FIBA).
   6. International Olympic Committee (IOC).

E. National Electrical Manufacturers Association (NEMA):
   1. NEMA MG 1 - Motors and Generators; 2021.

1.3 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

B. Coordinate backstops with structural system building framing as indicated in Specifications and Drawings to distribute loads to building framing without overloading building framing.

C. Coordinate backstops and support framing layout to avoid interferences with the following:
   1. HVAC equipment, ductwork, outlets, and inlets.
   2. Fire suppression system piping and sprinkler heads.
   3. Lighting.

D. Coordinate electrical requirements for the work in this Section with electrical service and connection points provided.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data:
   1. Submit data indicating loads, and materials of construction and thicknesses.
      a. Indicate data for components and accessories.
      b. Include manufacturer's full range of the following for selection by Architect:
         1) Colors and finishes.
         2) Graphics.
      c. Include operational instructions.

C. Suspended Backstops.
   1. Shop Drawings: Signed and sealed by licensed Professional Engineer.
      a. Indicate size and location of backstops, mounting details, accessory anchoring members.
      b. Indicate magnitude and location of loads imposed on building framing.
      c. Show operable backstops in fully extended and retracted positions.
      d. Indicate operator locations and mounting details. Include wiring diagrams for electric operators and controls.
   2. Design Data: Signed and sealed by licensed Professional Engineer.
      a. Submit calculations for system, mounting, anchor, and structure design.
         1) Include foundation design for in-ground mounted units.
      b. Submit calculations for supplementary framing required to attach backstops to building framing.
      c. Indicate location and magnitude of loads imposed on building framing.
      d. Seismic Design: Provide sealed calculations indicating that design of suspension systems provide compliance with seismic structural requirements indicated in the Performance and Design Requirements in this Section.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 77 00 - Closeout Procedures.

B. Operation and Maintenance Data: Include the following.
   1. Instructions for operational control systems, adjustments, and safety features.
   2. Parts catalog with complete list of replacement parts.
   3. Schematic wiring diagrams for electrical components.

1.6 QUALITY ASSURANCE

A. Products Requiring Electrical Connection: Listed and classified by UL or other testing firm acceptable to authority having jurisdiction.

B. Perform welding in accordance with AWS D1.1/D1.1M.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three (3) years documented experience.

B. Installer: Company specializing in performing work of this section with minimum three (3) years documented experience and approved by manufacturer.

C. Welders and Welding Procedures: AWS qualified within previous twelve (12) months.

D. Design backstops and support framing under direct supervision of licensed Professional Engineer experienced in design of this Work and licensed in the State in which the project is located.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept backstops on site in manufacturer's original packaging. Inspect for damage.

C. Store backstops indoors, protected from weather and contamination until installed.

1.9 WARRANTY

A. Section 01 77 00 - Closeout Procedures: Product warranties.

B. Indoor Suspended Backstops: Furnish lifetime manufacturer's warranty for masts and backboards.

1.10 SPARE PARTS AND MAINTENANCE PRODUCTS

A. Section 01 60 00 - Product Requirements: Extra materials, spare parts, and maintenance products.
   1. Furnish six (6) of each net type.
   2. Furnish four (4) manual crank tools and other tools required for backstop adjustments including adjusting height of backboard for play.

PART 2 PRODUCTS

2.1 INDOOR SUSPENDED BACKSTOPS

A. Performance And Design Requirements:
   1. Design backstops including masts, backboards, and goals to meet requirements of NFHS and the following:
      a. Withstand loads without damaging backstop.
      b. Transfer loads to building structural frame to prevent overloading and damage to building.
      c. Seismic Loads: Design and size components to withstand seismic loads and sway displacement as calculated in accordance with ASCE 7 and applicable codes.
         1) Seismic Design is to comply with requirements for the Seismic Design Category as indicated on the Structural Drawings and Section 00 31 00 - Available Project Information.

B. Manufacturers:
   1. American Athletic, Inc.
   2. Draper, Inc.
   3. Performance Sports Systems.
   4. Porter Athletic Equipment Company.
   5. Progressive Sports Construction Group.
   6. Substitutions: Section 01 60 00 - Product Requirements.

C. Basis of Design: Porter Athletic Equipment Company - Style 909xxxxx Series.

D. Backstop systems suspended from building structure above:
   1. Suspended and forward folding retraction:
      a. Operation:

1) Electric motorized winch.
b. Locations and Quantities:
1) High School Main Court; four (2) backstop systems.
2) High School Side Court: four (4) backstop systems.
3) Middle School Main Court; four (2) backstop systems.
4) Middle School Side Court: four (4) backstop systems.

E. Masts:
1. Center Post Masts: Single post at center of backboard with side sway bracing to eliminate sway and vibration during play.
2. Tubular steel, welded construction.
3. Overhead Mounting: Mast assembly extending vertically from overhead building structural frame to support backboard at position and height indicated on Drawings.
a. Design and provide supplemental steel framing as needed to span between and anchor to building structural frame and support mast at position indicated on Drawings.
4. For retractable folding backstop systems, provide winches and safety straps with retractor reel.
5. Furnish manufacturer's standard hardware for mast operation as specified.

F. Winches - Motorized Operation:
1. Electric motorized winch; sized to suit application with adjustable upper and lower limit switches.
2. Geared drive and cables designed to hold backstop at any position.
3. Motor: NEMA MG 1; 1/2 hp; 115 volts, single phase, 60 Hz; continuous duty rated.
4. Controls: Provide remote, flush, wall mounted control station three position key switch.
a. Gang Control Switch: Provide winch operation control switches as follows.
1) Main Court Backstops:
a) One (1) switch for all main court backstops simultaneously.
2) Side Court Backstops:
a) Individual switches for each side court backstop.
5. Disconnect Switch: Factory mount disconnect switch on equipment.

G. Backboards:
1. Glass Backboards: 1/2 inch thick clear shatter proof tempered glass, resiliently mounted in painted welded steel frame; target and border markings fired onto glass.
2. Rectangular shape; 72 x 42 inches with manufacturer's standard mounting to suit mast; drilled for goal mounting.
3. Molded safety padding installed along lower edge and corners.
4. Adjustable Vertical Movement Mounting: Variable height with rim height ranging from 8 to 10 feet above finished floor.
a. Manual crank tool operated from floor beneath backboard.

H. Goals and Nets:
1. Goals: Steel, removable type; fabricated from 5/8 Inches rod; 18 Inches inside clear diameter; with no-tie style net hooks; painted finish; mounted directly to main mast.
a. Breakaway type; single rim, breakaway type; rigid play up to 230 lbs, flexible for forces greater than 230 lbs.
2. Net: Woven chord, size, and style to fit goal; 15 to 18 inches long.
a. Competition Net: Anti-whip nylon.

I. Shop Finishing:
1. All metal components, parts, fasteners, and accessories to be powder coat finished.
2. Color: As selected by Architect from manufacturer's full range.

2.2 ACCESSORIES

A. Mounting Hardware: As designed and recommended by manufacturer.

2.3 FABRICATION

A. Verify field measurements prior to fabrication.

B. Fabricate components in largest practical sizes for delivery.

C. Grind exposed welded joints flush and smooth with adjacent finish surface.

D. Provide fittings and hardware to accommodate site assembly and installation.

E. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 73 00 - Execution: Verification of existing conditions before starting work.

B. Verify building structural frame is ready to receive backstops.

C. Verify that finishing work, including painting, is complete before installing backstops.

D. For work requiring electrical power connections, verify electrical power, with correct electrical characteristics, is installed at required locations and available.

3.2 PREPARATION

A. Section 01 73 00 - Execution: Prepare field conditions and existing construction for installation of work of this Section.

B. Prepare materials to be installed and equipment to be used during installation.

3.3 INSTALLATION

A. Section 01 73 00 - Execution: Related to installation of Work.

B. Install backstops in accordance with NFHS requirements.

C. Assemble components furnished loose for field assembly.

D. Install masts plumb and rigid at location indicated on Drawings.

E. Install backboards plumb, level, and parallel to basketball court end line.

F. Install goals level and adjust rim height to 10 feet above finish floor.

G. Install safety padding on backboards.

H. For winch operated backstops, install winches with cables connected to backstops.

I. For motorized and control components, make electrical connections as required for operation.

J. Touch up damaged finishes to match shop finish.

3.4 ADJUSTING

A. Section 01 73 00 - Execution: Requirements for starting and adjusting.

B. Adjust moving components and controls for smooth and proper operation over full range of movement.

C. For motorized components, adjust limit switches to prevent damage to equipment.

3.5 CLEANING

A. Section 01 73 00 - Execution and Section 01 77 00 - Closeout Procedures: Clean installed work and comply with manufacturer's recommendations.

B. Clean installed work in accordance with manufacturer's recommended materials and procedures.

3.6 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 73 00 - Execution: Requirements for protecting finished Work.

B. Fully retract retractable backstops and disable operators until Substantial Completion.

C. Protect install Work from damage.

3.7 DEMONSTRATION

A. Section 01 79 00 - Demonstration and Training: Requirements for demonstration and training.

B. Demonstrate to Owner representatives, operation and maintenance of operating components, and safety features.

END OF SECTION

SECTION 11 66 23.23
VOLLEYBALL EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Volleyball vertical net standards (pair of posts for volleyball net).
   2. Volleyball floor sleeves (pair of floor receptors for pair of vertical standards).

B. Related Requirements:
   1. Section 03 30 00 - Cast-In-Place Concrete: Placing of volleyball sleeves.
   2. Division 09 - Finishes: Flooring finishes surrounding floor sleeves.

1.2 REFERENCES

A. National Federation of State High School Associations:
   1. NFHS - Volleyball Rules Book; Current Edition.

1.3 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

B. Coordinate floor sleeves with requirements of volleyball vertical standards.

C. Coordinate installation of floor sleeves with placing of concrete slab and installation of finish flooring system.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Provide data indicating characteristics of materials, construction and fabrication of products and assemblies, sleeve cap locking options, and manufacturer's full range of colors and finishes available.

C. Shop Drawings: Indicate sizes, dimensions, locations, and construction details for installing the Work. Include details for concrete anchor of floor sleeves and flush cap finish at finish floor.

D. Certification of Coordination with Owner: In such case that volleyball net vertical standards are being provided by the Owner and Contractor is providing floor receptor sleeves for the Owner's standards, Contractor is to provide written certification indicating that all floor sleeve components and installation have been coordinated with Owner to be fully compatible with Owner's volleyball equipment. Indicate in the certificate the manufacturer and model number of the Owner's volleyball standards for which the floor sleeves are designed to receive.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 77 00 - Closeout Procedures.

B. Submit Operation and Maintenance Data.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five (5) years documented experience.

B. Installer: Company specializing in performing work of this section with minimum three (3) years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept volleyball equipment on site in manufacturer's original packaging. Inspect for damage.

C. Store volleyball equipment indoors, protected from weather and contamination until installed.

1.8 SPARE PARTS AND MAINTENANCE PRODUCTS

A. Section 01 60 00 - Product Requirements: Extra materials, spare parts, and maintenance products.
   1. Furnish four (4) keys for volleyball floor sleeve cover caps.

PART 2 PRODUCTS

2.1 DESIGN REQUIREMENTS

A. Design standards, sleeves, and net to meet requirements of NFHS and the following:
   1. Volleyball equipment to be competition grade.

2.2 VOLLEYBALL EQUIPMENT

A. Manufacturers:
   1. American Athletic, Inc.
   2. Draper, Inc.
   3. Gared Holding, LLC.
   4. Performance Sports Systems.
   5. Porter Athletic Equipment Company.
   6. Progressive Sports Construction Group.
   7. Substitutions: Section 01 60 00 - Product Requirements.

2.3 VOLLEYBALL EQUIPMENT SYSTEM

A. Quantities: Provide quantity of Volleyball Equipment System products equal to the number of pairs of Volleyball Vertical Net Standards indicated, unless indicated otherwise.

B. Volleyball Floor Sleeves: Steel; manufactured for use with volleyball vertical net standards; and each with key operated chrome or stainless steel cover plate.
   1. Quantity:
      a. Four (4) pair unless indicated otherwise on Drawings.

C. Volleyball Vertical Net Standards: Pair; extruded aluminum; 3-1/2 O.D.; telescoping type; protective padding.
   1. Basis of Design:
      a. Gared - Rallyline 6100 Series.
   2. Quantity:
      a. Four (4) pair unless indicated otherwise on Drawings.
   3. Finish:
      a. As selected by Architect from manufacturer's full range.

D. Net: Nylon competition type.

1. Basis of Design:
   a. Gared - Competition Volleyball Net.

E. Protective Padding: Polyester reinforced vinyl covers over 1-1/2 inch thick foam padding.
1. Basis of Design:
   a. Gared - Official Upright Pads.

F. Referee Stand: Fitted type; steel frame with nominal two (2) foot square platform; non-marking feet and 3 inch diameter wheels; protective padding.
1. Basis of Design:
   a. Gared - Volleyball Collapsible Referee Stand - 6448.

G. Storage and Transport Equipment:
1. Vertical Net Standard Storage Bracket: Stores pair of vertical net standards vertically; wall mounted brackets.
   a. Basis of Design:
      1) Gared - Vertical Volleyball Upright Storage Bracket - 6291.
2. Vertical Net Standard Transporter Cup: Steel cup with two (2) non-marring casters; sized to fit vertical net-standards.
   a. Basis of Design:
      1) Gared Volleyball 3-1/2” Upright Transporter - 6294.
3. Net Storage Rack: Transporter trolley with lockable non-marring swivel casters; capacity for rolling and storing two (2) volleyball nets.
   a. Basis of Design:
      1) Gared Store-It Double Net Storage Rack - 9940.

2.4 FINISHES

A. Colors to be as selected by Architect from full range unless indicated otherwise on Drawings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 73 00 - Execution: Verification of existing conditions before starting work.

B. Verify that field measurements are as required.

C. Verify that surfaces and conditions are ready to accept the work of this Section.

D. Examine products to be installed for damage and other conditions detrimental to completion of the Work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Section 01 73 00 - Execution: Prepare field conditions and existing construction for installation of work of this section.

B. Prepare materials to be installed and equipment to be used during installation.

3.3 INSTALLATION

A. Section 01 73 00 - Execution: Related to installation of Work.

B. Install sleeves without damaging vapor barrier under slab-on-grade.

C. Set up all equipment and tension volleyball net to ensure sleeves are installed properly.

1. Make adjustments required to bring entire volleyball assembly in conformance with NFHS.
2. In such case that the volleyball net vertical standards are being provided by Owner and Contractor is providing floor receptor sleeves for Owner's standards, Contractor is to coordinate this set up, assembly and adjustment procedure with Owner staff present to ensure that Contractor provided floor sleeves are appropriate and installed in a manner that allows for proper assembly of Owner's vertical standards and net system. Contractor is to make corrections to the work of floor sleeves as required to provide for proper assembly of Owner's vertical standards and net system.

3.4 CLEANING

A. Section 01 73 00 - Execution and Section 01 77 00 - Closeout Procedures.

B. Clean installed work and work area and comply with manufacturer's recommendations.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 73 00 - Execution: Protecting installed construction.

B. Protect work from damage.

END OF SECTION

SECTION 11 66 23.53
WALL PADDING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes wall padding and accessories.

B. Related Requirements:
   1. Section 04 20 00 - Unit Masonry: Substrate.

1.2 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Provide physical characteristics of wall pads and mounting accessories.

C. Shop Drawings: Indicate dimensioned elevations layout (include cutouts at wall devices), unit sizes and thickness, describe finish method around cutouts at wall devices, mounting details and hardware.

D. Samples for Initial Selection: Two manufacturer's complete sets of color samples illustrating the full range of finishes and colors available. Submit for Architect's initial selections.

E. Samples for Verification: From the Architect's initial selections, prepare and submit two samples for each selected finish and color; samples to be same product material type indicated for final Work; each sample 4 x 4 inches. Where finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.

1.3 CLOSEOUT SUBMITTALS

A. Section 01 77 00 - Closeout Procedures.

B. Submit Operation and Maintenance Data.

PART 2 PRODUCTS

2.1 WALL PADDING

A. Manufacturers:
   1. American Athletic, Inc.
   2. Draper, Inc.
   3. Performance Sports Systems.
   4. Porter Athletic Equipment Company.
   5. Progressive Sports Construction Group.
   6. Substitutions: Section 01 60 00 - Product Requirements.

2.2 COMPONENTS

A. Wall Pads: Urethane foam, 3.7 lb. density, 2 inches thick; over 3/8 inch OSB; flame retardant vinyl coated polyester covering; compliant with state and local codes.

2.3 ACCESSORIES

A. Wall Attachment Clip: Extruded aluminum.

B. Z-Channels: Extruded aluminum.

C. Floor Mounting Channel: Extruded aluminum (if Drawings indicate wall pads layout to extend to the floor).

D. Molded Cutout Inserts: Factory molded and flame retardant rubber inserts for pad cutouts for accessing electrical outlets and switches. Color to be selected by Architect from manufacturer's full range.

E. Fasteners to be non-corrosive and compatible with components and substrates.

2.4 FABRICATION

A. Wall Pads: Adhere foam to backing board. Wrap finish covering to back of backing board and fasten securely. Provide a one inch fastener margin at top and bottom of backing board covered by finish covering. Fabricate in 2 feet wide by 6 feet tall panels, unless indicated otherwise on Drawings.

2.5 FINISHES

A. Vinyl Coated Polyester Covering: Color as selected by Architect from manufacturer's full range.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 73 00 - Execution: Verification of existing conditions before starting work.

B. Verify adequacy of support framing and blocking.

3.2 PREPARATION

A. Section 01 73 00 - Execution: Prepare field conditions and existing construction for installation of work of this section.

B. Prepare materials to be installed and equipment to be used during installation.

3.3 INSTALLATION

A. Install wall pads in accordance with manufacturer’s instructions and as indicated on Drawings.

B. Use anchoring devices to suit conditions and substrate materials encountered.

C. Set wall pads plumb, square, aligned at top and bottom with adjacent pads, and securely anchored to building structure.

D. Provide anchorage to prevent wall pads from sliding laterally on z-clip mounting

E. Provide protected and finished cutouts for wall devices such as outlets and switches. Provide reinforced edge support at cutouts.

3.4 CLEANING

A. Section 01 73 00 - Execution and Section 01 77 00 - Closeout Procedures: Related to cleaning.

B. Clean wall pad covering and exposed mounting accessories.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 73 00 - Execution: Protecting installed construction.

END OF SECTION

Construction Documents 6/12/24

SECTION 11 66 43

INTERIOR SCOREBOARDS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Interior type electronic scoreboards including control center and other accessories for complete functional installation. Equipment to be designed for managing and displaying information for the following sports:
   1. Basketball.
   2. Volleyball.
   3. Wrestling.

B. Related Requirements:
   1. Division 26 - Electrical; electrical related requirements.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

B. Federal Communications Commission (FCC):
   1. FCC Rules and Regulations, Part 15; Current Edition.

C. National Electrical Code (NEC).
   1. NEC Article 600; Current Edition.

D. Underwriters Laboratories Inc. (UL):
   1. UL 48 - Standard for Safety for Electric Signs; 2011, Revisions 2022.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Data for scoreboards, controls, and accessories shall include descriptions of control functions.

C. Shop Drawings: Installation drawings, face layout, dimensions, construction, electrical wiring diagrams, and method of anchorage.

D. Samples: For each component requiring color selection, provide to the Architect samples indicating the manufacturer's full range of colors, textures, and finishes for selection.

E. Warranty(s) sample.

F. Manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

A. Source Limitation: All components including scoreboard, control center, control cable, and other accessories and installation hardware shall be products of a single manufacturer.

B. Manufacturer Qualifications: Company specializing in manufacturing electronic scoreboards with minimum ten (10) years of experience.

C. Scoreboards and other electrical components shall be certified and labeled in accordance with UL 48 for use in the United States.

D. Scoreboards and other electrical components are to be electrically grounded in accordance with NEC, Article 600.

1.5 WARRANTY

A. Section 01 77 00 - Closeout Procedures: Product warranties.

B. Provide manufacturer's warranty covering defects in materials and workmanship for a period of five (5) years beginning on the date of Substantial Completion.
   1. Exceptions:
      a. Wireless Components: Provide manufacturer's warranty covering defects in materials and workmanship for a period of two (2) years beginning on the date of Substantial Completion.
      b. Hand-Held Controls: Provide manufacturer's warranty covering defects in materials and workmanship for a period of one (1) year beginning on the date of Substantial Completion.

C. Provide manufacturer’s standard warranty as follows:
   1. Shot Clocks: Five (5) year warranty.

PART 2 PRODUCTS

2.1 SCOREBOARDS

A. Manufacturers:
   1. Daktronics, Inc.
   2. Electro-Mech Scoreboard Company.
   3. Nevco Inc.
   4. Varsity Scoreboards.

B. Basis of Design: Daktronics, Inc. - Model BB-2103.

C. Interior type, multi-purpose basketball/volleyball/wrestling electronic scoreboard with two integral horns, changeable captions, LED displays for time, scores, periods, fouling player number with personal fouls, team fouls, bonus and double bonus indicators, and next possession arrows. Team Name Message Centers (TNMC) are to be provided.
   1. Size: 8 feet long x 6 feet high x 8 inches deep.
   2. Hanging Weight: Approximately 195 pounds.
   3. Captions:
      a. 6 inches high:
         1) “Home”
         2) “Guest”
         3) Team Name Message Centers (TNMC)
      b. 3 inches high:
         1) T.O.L. captions.
      c. 4 inches high:
         1) All other captions not listed above.
   4. LED displays:
      a. Timing: Super bright amber 13 inches high digits with lit colon.
      b. Team Scores: Super bright red 13 inches high digits.
      c. Period: Super bright amber 10 inches high digits.
      d. Player Number With Personal Fouls, Game, And Weight: Super bright red 10 inches high digits.
      e. Team Fouls, Games Won, And Match: 10 inches high digits.
      f. Next possession: Super bright red arrow for each team.

g. Include bonus and double bonus as a 4 inch super bright amber LED “B”.
h. Time Outs Left (T.O.L.): Super bright amber 7 inches high digits.

5. Rear-lit captions are to require no maintenance.
6. Provide suspension anchoring and mounting.
7. Power Requirement: 158 Watts, MAX, 100-240 Volts AC w/Power Factor Correction.

D. Accessories:
1. Provide each scoreboard or accessory with control cable of length required. Electrical junction boxes, conduits, mounting hardware, and other accessories as required for installation are to be provided by others.
2. Provide Upper Corner Logo / Sponsor Panels.
3. Team Name Message Center (TNMC): “HOME” and “GUEST” caption plates to be replaced with programmable Team Name Message Center as manufactured by Daktronics Inc.
a. Specify changeable team names. (TNMC) Shall not require controller upgrade, use of additional accessories or computer.
4. Shot Clock Display Units: Connectivity and operation to be compatible with scoreboard system controller.
a. Basis of Design: Daktronics, Inc. - Model BB-2114
b. Numerals display to be 13 to 15 inches high, red LED type.
c. Shot Clock Assembly Configuration:
1) One shot clock unit per backstop system; foul-line viewing direction.
d. Shot Clock Assembly Locations: Mount on backstop frame in viewable position above backstop backboard.
1) Mount a shot clock assembly to four (4) separate backstop systems.
e. Shot clock control timer expiration is to signal an immediate shot clock time violation horn.
f. Control Connectivity: Provide compatible communication connectivity to scoreboard/shot clock controller.
1) Wireless transmission/reception connectivity.
g. Electrical Connection: Provide electrical connection to electrical service connection point provided by others.
1) .

E. Control Center:
1. Basis of Design: Daktronics, Inc. - All Sport 5000 Series.
2. Wireless, battery operated control center with receiver unit mounted at scoreboard.
3. Handheld wireless type, basic, AA battery operated, sport specific, control center with receiver unit mounted at scoreboard.
a. Quantity: One (1) unit.
b. Unit is to comply with Part 15 of FCC Rules and Regulations.
c. Control Unit: Heavy duty aluminum case.
1) Size: 4.25 x 16.25 x 9 inches.
d. Features:
1) Wireless operation within 500 feet.
2) Operate multiple scoreboards simultaneously.
3) System allows multiple controllers to link to individual scoreboards.
4) High visibility LCD display with a sealed keyboard.
5) Provide external battery kit.
a) Basis of Design: Daktronics SL-04457.
6) Provide 2.4 GHz spread spectrum radio control.
a) Basis of Design: Daktronics SL-04370.
7) Provide Game Clock/Horn controller.

8) Provide Shot Clock controller.

e. Receiver: Injection molded case, 5-1/2 by 3-3/4 by 2 inches mounted at scoreboard.

f. Maximum Range: 500 feet from control center to receiver.

g. Receiver is to require no additional source of power or separate control cable.

h. Power Adapters: Provide for each scoreboard receiver.

i. Provide carrying cases for control center and all necessary accessories.

2.2 MATERIALS

A. Aluminum face and perimeter frame: Fabricated from 0.050 inch minimum thickness, ASTM B221 aluminum sheet.

B. Finish: Acrylic polyurethane paint. Color to be as selected by Architect from manufacturer's full range of colors.

C. Electronics: Low voltage, solid state, 2-wire cable, multiplex system, quartz crystal controlled.

D. Provide fiber optic communication interface to reduce threat of damage from electrical storms.

E. LED (Light Emitting Diode) Units: Seven-bar, segmented digits in protective aluminum cover, rated typical life 100,000 hours, and designed to provide excellent visibility from all angles and sides.

F. Provide location specific universal power cord with plug for world-wide installation.

G. Control cable where required are to be UL listed, 2-wire, type RG-58/U, coaxial cable, 1/4 inch diameter.

H. Junction Boxes: Sheet metal box and cover, 4-1/2 x 2-1/8 x 2-1/8 inches minimum. complying with NEMA standards.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 73 00 - Execution: Verification of existing conditions before starting work.

B. Verify exact scoreboard and control center quantities and locations.

C. Verify and coordinate equipment electrical requirements to ensure proper power source, conduit, wiring, boxes, points of connectivity are provided and in locations required. Prior to installation, verify type and location of power supply.

D. Verify that power supplies are as required and that points of connection are located where required.

E. Verify that field measurements are as required.

F. Verify that surfaces and conditions are ready to accept the work of this Section.

G. Verify that building roof structure has been designed for loads of suspended scoreboards.

H. Examine products to be installed for damage and other conditions detrimental to completion of the Work.

I. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Section 01 73 00 - Execution: Prepare field conditions and existing construction for installation of work of this Section.

B. Prepare materials to be installed and equipment to be used during installation.

C. Coordinate requirements for electrical power, wall blocking, auxiliary framing and supports, suspension cables, and other components to be provided under other Specification Sections to ensure adequate provisions are made for complete, functional installation of scoreboards.

3.3 INSTALLATION

A. Section 01 73 00 - Execution: Related to installation of Work.

B. Install the work in compliance with the design requirements, applicable codes, manufacturer's recommendations, and the contract documents.

C. Before installation, field test scoreboards and accessories for operating functions. Ensure that scoreboards accurately perform all operations. Correct deficiencies.

D. Rigidly mount scoreboards and accessories level and plumb with brackets and fasteners.

E. Clean exposed surfaces.

F. Protect scoreboards and finishes from other construction operations.

3.4 ADJUSTING

A. Section 01 73 00 - Execution: Starting, testing, adjusting, and balancing.

B. Test and adjust system operation to function as required.

3.5 DEMONSTRATING AND TRAINING

A. Section 01 79 00 - Demonstration and Training: Provide demonstration and training to the Owner regarding operation and maintenance of components of the installed Work.

END OF SECTION

Construction Documents 6/12/24

SECTION 11 95 15

KILNS AND POTTERY STUDIO EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Electric Kilns with Ventilation System.

B. Related Requirements:
   1. Division 23 - Mechanical: Sections indicating venting and ventilation requirements.
   2. Division 26 - Electrical: Sections indicating electrical connections and requirements.

1.2 REFERENCES

A. Underwriters Laboratories Inc. (UL):
   1. UL (DIR) - Online Certifications Directory; Current Edition.
   2. UL (FDR) - Fire Resistance Directory; Current Edition.

1.3 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

B. Electrical Coordination:
   1. Coordinate electrical requirements of the Work of this Section with the electrical service.
   2. Provide electrical wiring and connections to electrical service.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
   1. Indicate locations and types of service fittings together with associated service supply connection required.
   2. Indicate duct and venting connections, electrical connections, and locations of access panels.
   3. Include roughing-in information for mechanical, plumbing, and electrical connections.
   4. Show adjacent walls, doors, windows, other building components, casework, and other equipment. Indicate clearances from above items.
   5. If a fume hood is indicated, include layout of fume hood in relation to ceiling conditions, lighting fixtures and air-conditioning registers and grilles. Indicate details for anchoring fume hoods to permanent building construction including locations of blocking and other supports. Include calculations demonstrating that anchorages comply with seismic performance requirements.
   6. Include coordinated dimensions for laboratory or other equipment specified in other Sections.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain kiln, kiln ventilation system and associated accessories through one source from a single manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect finished surfaces during handling and installation with protective covering of polyethylene film or other suitable material.

1.7 WARRANTY

A. Manufacturer's standard warranty covering parts and labor.

PART 2 PRODUCTS

2.1 PERFORMANCE AND DESIGN REQUIREMENTS

A. Electrical Components to be certified, listed, and labeled by the following standards organization(s) as suitable for the purpose indicated and installed conditions:
   1. UL (DIR).
   2. UL (FDR).
   3. Or, testing agency acceptable to local authorities having jurisdiction.

2.2 MANUFACTURERS

A. Manufacturers:
   1. American Art Clay Company.
   2. Bailey Ceramic Supply.
   3. Evenheat Kiln.
   4. Pargon Industries.
   5. Skutt Ceramic Products.
   6. Substitutions: Section 01 60 00 - Product Requirements.

B. Basis of Design: Skutt Ceramic Products.

2.3 KILNS - ELECTRIC TYPE

A. Basis of Design: Skutt Ceramic Products - KMT 1227-3 Kiln with EnviroVent 2 and blower ventilation system.
   1. Coordinate kiln and ventilation system electrical requirements with electrical service.
   2. Capacity: 9.9 cubic feet.
   3. Opening Size: 28 x 28 inches.
   4. Ventilation System: UL certified; exhaust duct system; electric exhaust blower; vented to outside building.
   5. Thermocouple:
      a. Type K.
   6. Delay Firing Start: Up to 99 hours and 99 minutes.
   7. Cone Fire Mode: Entry by cone number, 3 firing speeds, Cone 022 to Cone 10.
   8. Ramp Hold Mode: Entry by temperature, create programs from 1 to 8 segment. Each segment can specify rate of heating of cooling to a specified temperature with an optional hold, to maximum temperature of 2,400 degrees F.
   9. Memory: Hold up to 6 firing programs.
   10. Safety Features: Power failure detection, thermocouple failure detection, microprocessor fault detection.
   11. Digital Readout: Fahrenheit or centigrade.
   12. Program Review: Review Program and current segment during firing.
   13. Temperature Alarm: Adjustable to desired temperature.
   14. Control Panel: Sealed touch pad, washable.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 73 00 - Execution: Verification of existing conditions before starting work.

B. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of kiln and pottery wheel.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Section 01 73 00 - Execution: Prepare field conditions and existing construction for installation of work of this section.

B. Prepare materials to be installed and equipment to be used during installation.

3.3 INSTALLATION

A. Section 01 73 00 - Execution: Related to installation of Work.

B. General: Install pottery equipment according to Drawings and manufacturer's written instructions. Install level, plumb, and true; shim as required, using concealed shims, and securely anchor to building.

C. Comply with requirements in Division 26 Sections for installing electrical devices (NEMA Receptacle Configuration), and wiring. Install according to Shop Drawings and manufacturer's written instructions. Securely anchor fittings, piping, and conduit to kiln, unless otherwise indicated.

3.4 CLEANING

A. Section 01 73 00 - Execution and Section 01 77 00 - Closeout Procedures: Clean installed work and comply with manufacturer’s recommendations.

3.5 DEMONSTRATION AND TRAINING

A. Section 01 79 00 - Demonstration and Training: Provide demonstration and training to the Owner regarding operation and maintenance of componence of the installed Work.

3.6 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 73 00 - Execution: Protecting installed construction. Protect the Work from damage.

END OF SECTION

Construction Documents 6/12/24

SECTION 12 24 13

ROLLER WINDOW SHADES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes roller window shades:
   1. Manually operating shades.
   2. .

B. Related Requirements:
   1. Section 06 10 53 - Miscellaneous Rough Carpentry: Wood blocking and grounds for mounting roller shades and accessories.
   2. Section 08 41 13 - Aluminum-Framed Entrances and Storefronts.
   3. Section 08 44 13 - Glazed Aluminum Curtain Walls.
   4. Section 09 21 16 - Gypsum Board Assemblies: Coordination with gypsum board assemblies for installation of shade pockets, closures, and related accessories.
   5. Section 09 51 13 - Acoustical Panel Ceilings: Coordination with acoustical ceiling systems for installation of shade pockets, closures, and related accessories.

1.2 REFERENCES

A. ASTM International (ASTM):
   1. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, Editorial Changes 2021.

B. National Fire Protection Association (NFPA):
   1. NFPA 70 - National Electrical Code; 2023, Errata 2023.
   2. NFPA 701 - Fire Tests for Flame-Resistant Textiles and Films; 2023, Errata 2023.

1.3 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this Section. Review the work requirements, project conditions, sequencing, application procedures, quality control, testing and inspection and production schedule.

1.4 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

B. Coordinate with electrical contractor for appropriate location for power outlets as required by manufacturer’s equipment and installation requirements.

C. Coordinate with requirements of roller shade installer/dealer to ensure that no inaccessible areas are constructed.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Styles, material descriptions, dimensions of individual components, profiles, features, finishes and operating instructions.
   3. Storage and handling requirements and recommendations.

4. Mounting details and installation methods.
5. Typical wiring diagrams.

C. Shop Drawings: Plans, elevations, sections, product details, installation details, operational clearances, wiring diagrams and relationship to adjacent work.
1. Include Shade Schedule indicating size, location, width, and keys to details.
2. Window Treatment Schedule: For all roller shades. Use same room designations as indicated on the Drawings and include opening sizes and key to typical mounting details.

D. Samples for Initial Selection: For each finish product specified, submit two sets of shade material options and aluminum finish color samples representing manufacturer's full range of available colors and patterns. Include sample of shade material indicating fully fabricated bottom and side edges.

E. Samples for Verification: From the Architect's initial selections, prepare and submit two samples for each selection of metal finishes, shade system components, unassembled, demonstrating compliance with specified requirements. Include shade material selection samples, 12 x 12 inches with face of material marked to indicate interior faces.

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

1.6 CLOSEOUT SUBMITTALS

A. Section 01 78 23 - Operation and Maintenance Data.

B. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of shop drawings.

C. Manufacturer's Instructions and Maintenance Data: Methods for maintaining roller shades, precautions and recommendations regarding cleaning methods, cleaning materials and stain removal methods, instructions for operating hardware and controls.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with a minimum of five (5) years documented experience in manufacturing products specified in this section.

B. Obtain roller shades through one source from a single manufacturer.

C. Installer Qualifications: Installer trained and certified by the manufacturer. Company specializing in performing the type of work required in this section, with a minimum of five (5) years documented experience in installing.

D. Fire-Test-Response Characteristics: Passes NFPA 701 small and large-scale vertical burn. Materials tested shall be identical to products proposed for use.

E. Fungal Resistance: No growth when tested according to ASTM G21.

1.8 MOCK-UP

A. Section 01 40 00 - Quality Requirements: Mock-up requirements.

B. Provide a mock-up of one roller shade assembly for evaluation of mounting, appearance, and accessories.
1. Locate mock-up at location designated by Architect.
2. Do not proceed with remaining work until, mock-up is accepted by Architect.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Deliver shades in factory-labeled packages, marked with manufacturer and product name, fire-test-response characteristics, and location of installation using same room designations indicated on Drawings and in the submittal Shade Schedule.

1.10 PROJECT CONDITIONS

A. Section 01 60 00 - Product Requirements: Requirements before, during and after installation of Work.

B. Environmental Limitations: Install roller shades after finish work including painting is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.11 WARRANTY

A. Section 01 77 00 - Closeout Procedures: Product warranties.

B. Roller Shade Hardware and Chain Warranty: Manufacturer's standard non-depreciating twenty five (25) year warranty.

PART 2 PRODUCTS

2.1 ROLLER SHADES

A. Manufacturers:
1. Draper, Inc.
2. Hunter Douglas Corporation.
3. Lutron Electronics Company, Inc.
4. MechoShade Systems, Inc.
5. TimberBlindMetroShade.
6. Mermet

B. Basis of Design:
1. As indicated on Drawings.

2.2 MANUAL OPERATING SHADES

A. Mounting:
1. As indicated on Drawings.
2. Provide factory finished headbox with removable fascia to conceal roller(s) and operating mechanisms from view at all sides.

B. Width:
1. As indicated on Drawings.

C. Colors: Colors for fabrics and components exposed to view unless indicated otherwise on Drawings.
1. As selected by Architect from manufacturer’s full range.

D. Single Roller Type.
1. Fabric Material Type:
   a. Solar (glare) shade material.
2. Locations: As indicated on Drawings.

E. Fabric Material Types:
   1. Solar (glare) Shade Material:
      a. As selected by Architect from manufacturer's full range.

F. Clutch Operator: Manufacturer's standard material and design integrated with bracket/brake assembly.
   1. Provide a permanently lubricated brake assembly mounted on an oil-impregnated hub with wrapped spring clutch.
   2. Brake must withstand minimum pull force of 50 pounds (22.7 kg) in the stopped position.
   3. Mount clutch/brake assembly on the support brackets, fully independent of the roller tube components.

G. Drive Chain: Continuous loop stainless steel beaded ball chain, 95 pound (43 kg) minimum breaking strength. Provide upper and lower limit stops.
   1. Chain Retainer: Chain tensioning device complying with WCMA A100.1.

2.3 SHADE BAND

A. Shade Bands: Construction of shade band includes the fabric, the hem weight, hem-pocket, shade roller tube, and the attachment of the shade band to the roller tube. Sewn hems and open hem pockets are not acceptable.
   1. Hem Pockets and Hem Weights: Fabric hem pocket with RF-welded seams (including welded ends) and concealed hem weights. Hem weights shall be of appropriate size and weight for shade band. Hem weight shall be continuous inside a sealed hem pocket. Hem pocket construction and hem weights shall be similar, for all shades within one room.
   2. Shade Band and Shade Roller Attachment:
      a. Use extruded aluminum shade roller tube of a diameter and wall thickness required to support shade fabric without excessive deflection.
      b. Provide for positive mechanical engagement with drive / brake mechanism.
      c. Provide for positive mechanical attachment of shade band to roller tube; shade band shall be made removable / replaceable with a "snap-on" "snap-off" spline mounting, without having to remove shade roller from shade brackets.
      d. Mounting spline shall not require use of adhesives, adhesive tapes, staples, and/or rivets.
      e. Any method of attaching shade band to roller tube that requires the use of adhesive, adhesive tapes, staples, and/or rivets are not acceptable.

2.4 SHADE FABRICATION

A. Fabricate units to completely fill existing openings from head to sill and jamb-to-jamb, unless specifically indicated otherwise.

B. Provide battens in standard shades as required to assure proper tracking and uniform rolling of the shadebands. Contractor shall be responsible for assuring the width-to-height (W:H) ratios shall not exceed manufacturer's standards or, in absence of such standards, shall be responsible for establishing appropriate standards to assure proper tracking and rolling of the shadecloth within specified standards. Battens shall be roll-formed stainless steel or tempered steel, as required.

C. For railroaded shadebands, provide seams in railroaded multi-width shadebands as required to meet size requirements and in accordance with seam alignment as acceptable to Architect. Seams shall be properly located. Furnish battens in place of plain seams when the width, height, or weight of the shade exceeds manufacturer's standards. In absence of such

standards, assure proper use of seams or battens as required to, and assure the proper tracking of the railroaded multi-width shadebands.

D. Provide battens for railroaded shades when width-to-height (W:H) ratios meet or exceed manufacturer's standards. In absence of manufacturer's standards, be responsible for proper use and placement of battens to assure proper tracking and roll of shadebands.

2.5 COMPONENTS

A. Access and Material Requirements:
   1. Provide shade hardware allowing for the removal of shade roller tube from brackets without removing hardware from opening and without requiring end or center supports to be removed.
   2. Provide shade hardware that allows for removal and re-mounting of the shade bands without having to remove the shade tube, drive, or operating support brackets.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 73 00 - Execution: Verification of existing conditions before starting work.

B. Verify field measurements are as shown on shop drawings.

C. Examine substrates for conditions detrimental to installation of the Work. Proceed with installation only after unsatisfactory conditions have been corrected.

D. Examine products to be installed for damage and other conditions detrimental to completion of the Work. Proceed with installation only after unsatisfactory conditions have been corrected.

E. Verify that required electrical service is available, in proper location, and ready for installation of the work of this section.

3.2 PREPARATION

A. Section 01 73 00 - Execution: Prepare field conditions and existing construction for installation of work of this section. Prepare materials to be installed and equipment used during installation.

B. Clean surfaces thoroughly prior to installation.

C. Prepare surfaces for installation of the work.

3.3 INSTALLATION

A. Section 01 73 00 - Execution: Related to installation of Work.

B. Install roller shades level, plumb, square, and true according to components in accordance with manufacturer's written instructions and located so shade band is not closer than 2 inches to interior face of glass. Allow proper clearances for window operation hardware.

3.4 ADJUSTING

A. Section 01 73 00 - Execution: Starting, testing, adjusting, and balancing.

B. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.5 CLEANING

A. Section 01 73 00 - Execution and Section 01 77 00 - Closeout Procedures: Related to cleaning.

B. Clean roller shade surfaces after installation, according to manufacturer's written instructions.

3.6 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 73 00 - Execution: Protecting installed construction.

B. Protect installed work from damage.

3.7 DEMONSTRATION AND TRAINING

A. Section 01 79 00 – Demonstration and Training.

B. Provide demonstration and train to Owner's maintenance personnel to adjust, operate and maintain roller shade systems.

END OF SECTION

SECTION 12 32 16

MANUFACTURED PLASTIC-LAMINATE-CLAD CASEWORK

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Manufactured plastic-laminate-clad casework.
   2. Countertops.
   3. Casework hardware.

B. Related Requirements:
   1. Section 09 65 00 - Resilient Flooring: Rubber base.
   2. Division 22 - Plumbing Fixtures: Sinks set in countertops.

1.2 DEFINITIONS

A. Identification of Casework Parts by Surface Visibility:
   1. Unit Body with Open Interior: Storage unit surfaces without solid door or drawer fronts, and units with glass sliding or glass framed doors.
   2. Unit Body with Closed Interior: Storage unit surfaces with closable solid door or drawer fronts.
   3. Exposed Surface: Surface that is visible.
   4. Concealed Surface: Surface that is not visible after installation.

1.3 REFERENCES

A. American National Standards Institute (ANSI):
   1. ANSI A135.4 - Basic Hardboard; 2012, Reapproval 2020.
   2. ANSI A208.1 - Particleboard; 2022.

B. ASTM International (ASTM):
   1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

C. Architectural Woodwork Manufacturers Association of Canada (AWMAC) and the Woodwork Institute (WI):
   1. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.

D. California Department of Public Health (CDPH):
   1. CDPH Standard Method VOC V1.2 - Standard Method For The Testing And Evaluation Of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers - Version 1.2; 2017.

E. National Electrical Manufacturers Association (NEMA):
   1. NEMA LD 3 - High Pressure Decorative Laminates; 2005.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting not less than one week before starting work of this section; require attendance by all affected installers.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data describing casework finishes and construction.

C. Shop Drawings:
1. Scale of Drawings: 1-1/2 inch to 1 foot, minimum.
2. Provide the information required by AWMAC/WI (NAAWS) and to include the following:
a. Indicate component dimensions, configurations, elevations, cross-sections, construction details, joint details, hardware locations, service run spaces and location of services. Include layout of units with relation to surrounding walls, doors, windows, and other building components.
b. Include details for fabrication of vanity and countertop supports, brackets, and finishes.

D. Samples for Initial Selection: Two manufacturer's color samples illustrating the full range of finishes, patterns, and colors available for each finish surface type, trim and hardware indicated; submit for Architect's initial selections.

E. Samples for Verification: From the Architect's initial selections, prepare and submit two samples for each selected finish, pattern, and color; minimum 4 x 4 inch samples and actual hinge and pull. Where finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.

F. Certificate: Submit labels and certificates required by quality assurance and quality control programs.

1.6 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum ten (10) years documented experience.

B. Installer: Company specializing in the installation of casework with minimum five (5) years documented experience and approved by the manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Store completed casework and countertops in a ventilated space with relative humidity range of 20 to 50 percent.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.

B. Do not install casework in unconditioned spaces, or in spaces where relative humidity is not within acceptable limits.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Work of this Section is to comply with AWMAC/WI (NAAWS), unless indicated otherwise.

B. AWMAC/WI (NAAWS) Quality Standard:
1. Custom Grade.

2.2 MANUFACTURED PLASTIC-LAMINATE-CLAD CASEWORK

A. Manufacturers:
1. Biggs Casework, Inc.
2. Blair-Dumond, Inc.
3. Cabinets by Design, Inc., Duluth GA.
4. Case Systems.
5. Cleora Sterling Corporation.
6. Interior Wood Specialties, Inc.
7. Kewaunee Scientific Corporation.
8. Pridgen Cabinetworks.
9. Stevens Industries Inc.
10. TMI Systems Design Corporation.
11. Substitutions: Section 01 60 00 - Product Requirements.

2.3 COMPONENTS

A. Particleboard: ANSI A208.1; 45 pound density, fir, or pine.
1. Interior Composite Wood Products: CDPH Standard Method VOC V1.2.
2. Use Moisture Resistant Particleboard on countertops in wet areas and at sinks.

B. Hardboard: ANSI A135.4; prefinished; 1/4 inch thick.

C. Melamine: Melamine resin laminate sheet; thermally fused to panel core material. Colors indicated in FINISHES article in this Section.

D. PVC Edging: Extruded PVC, self-locking serrated tongue, of width to match component thickness. Colors indicated in FINISHES article in this Section.
1. Convex face with smooth finish.

E. Plastic Laminate: High Pressure Decorative Laminate (HPDL) complying with AWMAC/WI (NAAWS) and NEMA LD 3. Colors indicated in FINISHES article in this Section.

F. Solid Surface Material: Cast polymeric resin.
1. Provide finished products having flame spread index of 35 or less, and smoke developed index of 15 or less, when tested in accordance with ASTM E84 in thickness of 3/4 inch.
2. Resin: Polyester type, with integral coloring, stain resistant to domestic chemicals and cleaners.
3. Colors indicated in FINISHES article in this Section.
4. Polishing Cream: Compatible polishing cream to achieve specified finish sheen.
5. Adhesive: Type recommended by solid surface manufacturer and coordinated for bonding to substrate type.

G. Cabinet Hardware:
1. Pulls:
a. Attachment:
1) 4 inch centers.
b. Finish and Color:
1) Powder coated wire; color as selected by Architect from manufacturer's full range.
2. Hinges: Heavy duty, exposed 5 knuckle, fixed pin, hospital-tip style.
a. Finish and Color:
1) To match Pulls.
3. Magnetic Catches: Aluminum case with zinc plated steel strike, 6 lb. pull minimum.

4. Door & Drawer Locks: Cam type, disc tumbler capable of being master keyed; stainless steel, satin finish. Each room, keyed alike and separate from other rooms and all locks master keyed.
   a. Drawers: Lock quantities and locations.
      1) Provide keyed locks at locations indicated on Drawings.
   b. Doors: Lock quantities and locations.
      1) Provide keyed locks at locations indicated on Drawings. For double door cabinet units receiving keyed lock, provide interior release/latch for adjacent door.
5. Coat Hooks: Ceiling and wall surface mounted types.
   a. Double prong wardrobe design; stainless steel.
   b. Finish and Color: To match Pulls.
   c. Hook quantities and locations; to be mounted in casework units as follows:
      1) Provide coat hooks at locations indicated on Drawings.
6. Hardware Fasteners: Exposed fasteners to match material and finish of installed device.
7. Where door opens against adjacent construction, provide chain or other restraint device to prevent door and door hardware from contacting adjacent construction.
8. Drawer Slides:
   a. Standard Drawers: Nylon ball bearing, self-closing; 75 pound capacity.
   b. File Drawers: Full extension, ball bearing, self-closing; 100 pound capacity.
9. Adjustable Shelf Supports:
   a. Heavy duty, polycarbonate; clear; pin type; shelf locking clip.
10. Casters: Double ball bearing mounting to heavy gage zinc plated fork; 5 inch soft rubber wheels. Provide two brake units per mobile unit.

H. Fixed Vanity and Countertop Brackets:
   1. Brackets to comply with Americans with Disabilities Act (ADA) where applicable.
   2. Material:
      a. Stainless steel; satin finish.

I. :Bolts, Nuts, Washers, Lags, Anchors, Pins, Fasteners, and Screws: As indicated on Drawings and otherwise to be of size and type to suit application; galvanized finish in concealed locations and stainless steel in exposed locations.

2.4 FABRICATION

A. Verify field measurements prior to fabrication.

B. Fabricate laminate clad casework to dimensions, profiles and details shown.

C. Joinery Dowels: Industrial grade hardwood dowels, glued and clamped tight.

D. Construct cabinet bodies with 3/4 inch particleboard for sides, fixed intermediates, subtops, and bottoms. Stretchers, where allowed, to be minimum 4 inch wide.
   1. Subtops to be solid particleboard; no stretchers allowed for subtops.

E. Construct shelving up to 30 inches wide with 3/4 inch particleboard. Construct shelving greater than 30 inches wide with 1 inch particleboard.

F. Construct cabinet backs with 1/2 inch particleboard.

G. Construct drawers with 1/2 inch particleboard for sides, back, and subfront. Construct drawer bottoms with 1/2 inch prefinished hardboard.

H. Construct doors, and drawer fronts with 3/4 inch particleboard.

I. Construct countertops as follows:
   1. Use Moisture Resistant Particleboard in wet areas and countertops with sinks.

2. Use 1-1/8 inch particleboard for countertops finished with Plastic Laminate.
3. Use 3/4 inch particleboard for countertops finished with Solid Surface (Synthetic Surface) type material.

J. All components to be of balanced construction. Plastic laminate faced particleboard to be balanced with high pressure cabinet liner on opposite side unless otherwise noted. Melamine faced particleboard to be balanced with melamine.

K. Wall Hung Units:
1. Top surfaces of wall hung units to be finished with same material as visible vertical end panels.
2. Bottom surfaces of wall hung units to be finished with melamine on surfaces and color matching PVC panel edging.

2.5 FINISHES

A. Doors:
1. Front and Interior: Plastic laminate VGS28 with 3mm PVC edging.

B. Drawers:
1. Fronts: Plastic laminate VGS28 with 3mm PVC edging.
2. Interiors: Melamine with 1mm PVC edging.

C. Unit Body with Closed and Open Interiors:
1. Interior Surfaces: Melamine with 1mm PVC edging.
2. Exposed Surfaces: Plastic laminate VGS28 with 1mm PVC edging.
3. Shelves: Melamine on both sides.
   a. Shelf Edging for Closed Interiors: 1mm PVC edging.
   b. Shelf Edging for Open Interiors: 3mm PVC edging.

D. Countertops:
1. Plastic Laminate Clad Type: HGS/HGP48 with 3mm PVC edging.
   a. Locations: All countertops unless otherwise indicated.
2. Solid Surface Material Type: Cast polymeric resin.
   a. Locations: As indicated on Drawings.

E. Finishes Colors and Textures:
1. Melamine: White.
2. PVC Edging:
   a. Colors and textures as selected by Architect from manufacturer's full range.
3. Plastic Laminate:
   a. Colors and textures as selected by Architect from manufacturer's full range.
4. Solid Surface Material:
   a. Colors and textures as selected by Architect from manufacturer's full range.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 73 00 - Execution: Verification of existing conditions before starting work.

B. Verify adequacy of backing and support framing.

C. Verify location and sizes of utility rough-in associated with work of this Section.

3.2 PREPARATION

A. Section 01 73 00 - Execution: Prepare field conditions and existing construction for installation of work of this section.

B. Prepare materials to be installed and equipment to be used during installation.

3.3 INSTALLATION

A. Section 01 73 00 - Execution: Related to installation of Work.

B. Install work in accordance with AWMAC/WI (NAAWS) requirements for grade indicated.

C. Set and secure casework in place; rigid, plumb, and level.

D. Use fixture attachments in concealed locations for wall mounted components.

E. Use concealed joint fasteners to align and secure adjoining cabinet units and counter tops.

F. Carefully scribe casework abutting other components and construction, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.

G. Secure cabinets, brackets and bases to floor and wall substrates using appropriate angles and anchorages.

H. Seal joints at abutment to other construction with appropriate sealant matching casework finish.

I. Sequence installation and erection to ensure mechanical and electrical connections are achieved in an orderly and expeditious manner.

3.4 ADJUSTING

A. Section 01 73 00 - Execution: Starting, testing, adjusting, and balancing.

B. Adjust moving or operating parts to function smoothly, without binding and correctly.

C. Repair or remove and replace defective work to new condition.

3.5 CLEANING

A. Section 01 73 00 - Execution and Section 01 77 00 - Closeout Procedures: Related to cleaning.

B. Clean casework, counters, shelves, hardware, fittings, and fixtures.

3.6 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 73 00 - Execution: Protecting installed construction.

B. Protect Work from damage, including damage from detrimental air temperature and humidity levels.

END OF SECTION

SECTION 12 35 53.19
WOOD LABORATORY CASEWORK

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Manufactured wood laboratory casework and accessories.

B. Related Sections:
1. Section 09 65 00 - Resilient Flooring: Rubber base.
2. Section 12 32 16 - Manufactured Plastic-Laminate-Clad Casework.
3. Division 22 - Plumbing: Plumbing requirements related to the Work of this Section.
4. Division 26 - Electrical: Electrical requirements related to the Work of this Section.

1.2 DEFINITIONS

A. Identification of Casework Parts by Surface Visibility:
1. Unit Body Open Interiors: Any storage unit surface without solid door or drawer fronts and units with glass sliding or glass framed doors.
2. Unit Body Closed Interiors: Any storage unit surface behind solid door or drawer fronts.
3. Unit Body Exposed Side: Any storage unit exterior side surface that is visible after installation.
4. Concealed Surfaces: Any surface not normally visible after installation.

1.3 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate the Work with required services to casework.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data on casework finishes.

C. Shop Drawings: Include component dimensions, configurations, elevations, cross-sections, construction details, joint details, service run spaces and location of services. Include layout of units with relation to surrounding walls, doors, windows, and other building components.

D. Manufacturer’s Installation Instructions: Submit special precautions for installation.

E. Maintenance Data: Submit instructions for cleaning stains from finish of casework and countertops.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in the manufacturing of products specified in this Section with minimum three (3) years documented experience.

B. Installer: Company specializing in installing the work of this Section with three (3) years documented experience and approved by the Manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Store completed casework and countertops in a ventilated space with relative humidity range of 20 to 50 percent.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Requirements before, during and after installation of Work.

B. Do not install casework in unconditioned spaces, or in spaces where relative humidity is not within acceptable limits.

PART 2 PRODUCTS

2.1 WOOD LABORATORY CASEWORK

A. Manufacturers:
1. ALC - Collegedale.
2. Campbell Rhea.
3. Diversified Woodcrafts, Inc.
4. Kewaunee Scientific Corporation.
5. Sheldon Labs.
6. Substitutions: Section 01 60 00 - Product Requirements.

2.2 COMPONENTS

A. Hardwood Lumber (Exposed to View): White Oak, NHLA grade FAS or better, free from defects, maximum moisture content of 6 percent.

B. Hardwood Lumber (Concealed from View): Any species, NHLA grade FAS or better, maximum moisture content of 6 percent.

C. Hardwood Plywood (Exposed to View): White Oak veneer, plain sliced, slip matched, grade A-2, crossbanded with solid core, minimum number of plies as follows:
1. 3/4 Inch: 7 ply.

D. Hardwood Plywood (Concealed from View): Any species veneer, sound grade, crossbanded with solid core, minimum number of plies same as Oak plywood.

E. Hardboard: Tempered, exploded wood fibers compressed with natural resins and other binders, 50 pcf density minimum, 1/4 inch thick.

F. Particleboard: Industrial grade, 45 pcf density minimum.

G. Leg Shoes (When shown in Plan): Closed bottom style.

H. Countertops: Phenolic Resin, non-glare, black finish; minimum 1 inch thick with radiused edges.

I. Sinks: Drop in molded modified epoxy resin, non-glare black finish.

J. Cabinet Hardware:
1. Hinges: Heavy duty stainless steel construction exposed 5 knuckle type with hospital tip, fixed pin.
2. Catches: Friction roller type, spring cushioned, polyethylene or nylon roller, metal strike plate.
3. Pulls: Extruded aluminum bar type, satin finish, 4 inch centers.
4. Drawer Slides: Heavy duty epoxy coated steel, ball bearing nylon rollers, automatic positive stop levers, non-tool type drawer removal.
   a. Use full extension slides at file drawers.

5. Adjustable Shelf Supports: Heavy duty, steel pin with nylon caps or polycarbonate with non-tip safety feature.
6. Door and Drawer Locks: Cam type disk tumbler, brass key and tumbler with zinc alloy cylinder; lock capable of being master keyed.

2.3 FABRICATION

A. Verify field measurements prior to fabrication.

B. Fabricate laboratory casework to dimensions, profiles, and details shown.

C. Cabinet Joinery: Industrial grade hardwood dowels or screws, glued and clamped tight.

D. Construct cabinet bodies with 1 inch thick solid red oak top rails and 1 inch thick solid red oak intermediate rails. Cabinet sides to be constructed of 3/4 inch hardwood plywood for concealed surfaces and 3/4 inch thick red oak plywood for semi-exposed and exposed surfaces.

E. Construct cabinet backs with 1/4 inch thick hardboard for concealed surfaces, 1/4 inch thick red oak plywood for semi-exposed surfaces, and 3/4 inch thick red oak plywood for exposed surfaces.

F. Construct shelving with 3/4 inch thick hardwood plywood with hardwood edging for unexposed surfaces, and with 3/4 inch thick white oak plywood with solid white oak edging for semi-exposed and exposed surfaces.

G. Construct doors with solid white oak banding, 3/4 inch thick, encasing particleboard core red oak plywood. All edges to be radiused.
1. Grain for door and drawer fronts to be vertical matched.

H. Construct drawers with 1/2 inch hardwood lumber for sides and back. Construct drawer bottom with 1/4 inch plywood or hardboard. Construct drawer fronts with minimum 13/16 inch red oak lumber dovetailed into drawer sides. Drawer front edges to be radiused.

I. Tables (When shown in Plan): Construct tables with 2-1/4 inch square laminated solid red oak legs and minimum 3/4 inch thick solid red oak side and center rails, 4-3/16 inches wide. Exterior rails attached together with corner braces, mortised, and screwed; center rails attached to exterior rails with dowels and glue. Attach legs to table frame with lag or hanger bolts machine driven into legs and attached to corner braces. Provide leg shoes for all legs. Provide solid red oak leg stretchers between all legs.

J. Sinks to be under-slung type and adhered to bottom of countertop. Provide sink supports on cabinet bodies.

K. Provide 4 inch high Phenolic resin back splashes on all countertops abutting walls. Provide 4 inch high side splashes on side of countertops abutting walls.

2.4 FINISHES

A. Exposed to View Surfaces: One coat stain, to match adjacent entry doors; one coat catalyzed sealer; top coat of clear, catalyzed conversion varnish or catalyzed acrylic.

B. Semi-Exposed Surfaces: Same as exposed to view surfaces.

C. Concealed Surfaces: Base coat of catalyzed sealer, top coat of clear, catalyzed conversion varnish or catalyzed acrylic.

D. Finished surfaces to have chemical resistance performance as follows:
1. Surfaces to exhibit little or no effect to exposure to the following chemicals and solutions:
Acetic Acid - 50% Acetone

Ammonium Hydroxide - 28%
Benzene
Carbon Tetrachloride
Ethyl Acetate
Ethyl Alcohol
Ethyl Ether
Formaldehyde
Gasoline
Hydrochloric Acid - 37%
Methanol (Methyl Alcohol)
Methyl Ethyl Ketone
Naphtha
Nitric Acid - 10%
Phosphoric Acid - 75%
Potassium Hydroxide - 50%
Sodium Carbonate
Sodium Hydroxide - 40%
Sulfuric Acid
Toulene
Xylene

2.5 LABORATORY ACCESSORIES

A. Solvent (Flammable) Storage:
   1. Basis of Design: Campbell Rhea - Model 6778.
   2. Design and construct in accordance with OSHA regulations, FM, UL and NFPA 30, National Fire Protection Association, Flammable and Combustible Liquids Code. Cabinets shall be Factory Mutual (FM) approved and Underwriters (UL) listed with UL/FM approval label affixed to inside of cabinet door.
   3. Ventilation: Two threaded, two inch pipe vent outlets and flame arrestors on the back of the cabinet. Vent to the exterior and as required by local code.
      a. Coordinate with the Mechanical Work as described in Division 23.
   4. Identification: Two inch high lettering: FLAMMABLE KEEP FIRE AWAY.
   5. Room where solvent storage is located shall have a negative pressure rating.

B. Wall Mounted Peg Board:
   1. Basis of Design: Campbell Rhea - Model 6664.
   2. Drying rack shall be Factory Mutual (FM) approved and Underwriters (UL) listed with UL/FM approval label affixed to inside of cabinet door.
   3. Provide phenolic resin back with polypropylene pegs.
   4. Provide stainless-steel drip troughs with drain outlet.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 73 00 - Execution: Verification of existing conditions before starting work.

B. Verify dimensions, tolerances, and methods of attachment with other Work.

C. Verify adequacy of backing and support framing.

3.2 PREPARATION

A. Section 01 73 00 - Execution: Prepare field conditions and existing construction for installation of work of this Section.

B. Prepare materials to be installed and equipment to be used during installation.

3.3 INSTALLATION

A. Section 01 73 00 - Execution: Related to installation of Work.

B. Install casework in accordance with manufacturer’s instructions.

C. Use anchoring devices for materials encountered and usage expected.

D. Set casework plumb, square, and true, securely anchored to building structure. Shim as required.

E. Where casework abuts other finished work, scribe and cut to accurate fit.

F. Sequence installation and erection to ensure mechanical and electrical connections are achieved in an orderly and expeditious manner.

3.4 ADJUSTING

A. Section 01 73 00 - Execution: Starting, testing, adjusting, and balancing.

B. Adjust doors, drawers, hardware, fixtures and other moving or operating parts to function smoothly and correctly.

C. Repair or remove and replace defective Work as directed by Architect.

3.5 CLEANING

A. Section 01 73 00 - Execution and Section 01 77 00 - Closeout Procedures: Related to cleaning.

B. Clean casework, counters, shelves, hardware, fittings, and fixtures.

3.6 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 73 00 - Execution: Protecting installed construction.

B. Protect casework from damage until final acceptance.

END OF SECTION

Construction Documents 6/12/24

SECTION 12 66 13

TELESCOPING BLEACHERS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Telescoping bleachers.
      a. Electric motor operators, controls, and internal wiring.

B. Related Requirements:
   1. Division 09 - Finishes: Sections indicating flooring system on which bleachers set and operate. Refer to COORDINATION article in this Section.
   2. Contract Documents related to wall construction adjacent to rear of bleachers system.
   3. Division 26 - Electrical: Sections regarding electrical work.

1.2 REFERENCE STANDARDS

A. Americans with Disabilities Act (ADA):
   1. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; Current Edition.

B. American Lumber Standard Committee (ALSC):
   1. ALSC PS 20 - American Softwood Lumber Standard; 2021.

C. ASTM International (ASTM):
   1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
   2. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes;2021a.
   3. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2022.
   4. ASTM D1248 - Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable; 2016.
   5. ASTM D1929 - Standard Test Method for Determining Ignition Temperature of Plastics; 2023.
   6. ASTM D2843 - Standard Test Method for Density of Smoke from the Burning or Decomposition of Plastics; 2022.
   7. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023a.

D. American Welding Society (AWS):
   1. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, Errata 2022.
   2. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2018.

E. International Building Code (IBC):
   1. IBC 2021.

F. International Code Council (ICC):
   1. ICC 300 - Bleachers, Folding And Telescopic Seating, And Grandstands; 2017.

G. National Fire Protection Association (NFPA):
   1. NFPA 102 - Standard for Grandstands, Folding and Telescopic Seating, Tents, and Membrane Structures; 2021.

H. National Institute of Standards and Technology (NIST):
   1. NIST PS 1 - Structural Plywood; 2019.

1.3 COORDINATION

A. Coordinate requirements of the work of this Section with finish flooring requirements for adequate support and operation of the bleacher system.
   1. In the case of a composite finish flooring systems (e.g. wood strip flooring on plywood and sleepers), coordinate flooring and bleachers requirements for solid blocking within the flooring assembly for adequate weight support of retracted, fully extended, and fully loaded bleacher system supports.

1.4 SUBMITTALS

A. See Section 01 33 00 - Submittal Procedures: Submittal Procedures.

B. Product Data: Manufacturer's data sheets on each product to be used.

C. Shop Drawings: Indicate layout and dimensions of bleacher units including seat heights, row spacing and rise, aisle widths and locations, overall dimensions in closed and open position, connections and relationship to adjoining work, accessories, types of materials and finishes.
   1. Include data for structural computations, materials properties, and other information needed for structural analysis. Data is to be signed and sealed by a qualified Professional Engineer responsible for preparation of data, and licensed in the State in which the project is located.
   2. Provide shop drawings specific to this Project.
   3. Graphics Layout Drawings: Indicate pattern of seat colors as indicated on Drawings.
   4. Wiring Diagrams: Show locations of motors, electrical wiring, and rough-in connections.

D. Samples for Initial Selection: For each material for which color selection is required, submit samples, 2 by 2 inches in size, illustrating the full range colors and finishes available; submit for Architect’s initial selection.

E. Samples for Verification: From the Architect’s initial selections, submit samples of actual finish or product, for verification of color selection.

F. Certifications: Provide qualifications certification for the following:
   1. Manufacturer.
   2. Installer.
   3. Engineer.
   4. Welders.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 77 00 - Closeout Procedures.

B. Operation and Maintenance Data: Manufacturer's operation and maintenance instructions, including annual inspection and maintenance and bi-annual inspection by a Professional Engineer or manufacturer factory service personnel.

C. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.6 QUALITY ASSURANCE

A. Design to comply with all applicable code requirements.

B. Seating Layout: Comply with current ICC 300 for Folding and Telescopic Seating, except where additional requirements are indicated or imposed by authorities having jurisdiction.

C. Welding Standards & Qualification: Comply with AWS D1.1/D1.1M and AWS D1.3/D1.3M.

1.7 QUALIFICATIONS

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this Section, with not less than ten (10) years of documented experience.

B. Installer Qualifications: Certified as approved by Manufacturer.

C. Engineer Qualifications: Bleacher system to be designed, sealed and signed by a Registered Professional Engineer.

D. Welder Qualifications: Certified by AWS for the processes employed.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept products in manufacturer's packaging clearly labeled with manufacturer name and content. Inspect for damage.
   1. Store, in original packaging, under cover and elevated above grade.

1.9 WARRANTY

A. Section 01 77 00 - Closeout Procedures: Product warranties.

B. Manufacturer's five (5) year warranty for all work and materials to be free of defects. Replace parts that fail under normal use at no extra charge to Owner.

PART 2 PRODUCTS

2.1 BLEACHERS

A. Manufacturers:
   1. Hussey Seating Company.
   2. Interkal, LLC.
   3. Irwin Seating Company.
   4. Kodiak Seating by Royal Stewart Ltd.
   5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Basis of Design:
   1. Hussey Seating Company - Maxam 26 Series.

2.2 TELESCOPING BLEACHERS

A. Telescoping Bleachers: Factory assembled tiered benches that retract horizontally into depth approximately the same as a single row depth, with fixed seats mounted on leading edge of platforms.
   1. Bleacher system to be designed, sealed and signed by a licensed Professional Engineer licensed in the State in which the Project is located.
   2. Provide a design that has been in use for at least 5 years; submit documentation.
   3. Design to comply with applicable requirements of NFPA 102 and requirements of code authorities having jurisdiction; where conflicts between requirements occur, comply with whichever is more stringent.

4. Design with solid seat fronts that conceal interior mechanisms when fully retracted, fitting tightly enough to prevent climbing up face; at front row provide key locked, hinged fascia (skirt) to cover gap between seat riser/fascia and floor.
5. Configurations: As indicated on Drawings.
6. Operation:
   a. Electric motor operation.
7. Extension Direction:
   a. Forward-Fold Extension: Top row fixed to floor, adjacent to wall under overhang, forward extension (away from wall); attachment to wall is acceptable when Registered Engineer's design includes anchorage designed for wall construction.
8. Wheelchair Viewing Spaces: Provide wheelchair viewing spaces as follows. Provide removable railings at row behind wheelchair spaces. All wheelchair viewing spaces are to comply with ADA Standards.
   a. Retractable Wheelchair Spaces: Provide manually retractable spaces with operation that does not affect other seating rows. Number of spaces and locations to be as follows:
      1) Evenly distribute the following spaces across entire set of bleachers front row (floor level):
         a) 16 spaces, evenly distributed.
9. Cutouts: Fit units to irregular wall surfaces, columns, pilasters, roof drain leaders, and other obstructions; take field measurements prior to fabrication.

B. Design Loads: Design to withstand the following loading conditions, in addition to its own weight:
1. Live Load on Structural Supports: 100 pounds per square foot minimum, of gross horizontal projection.
2. Live Load on Seats and Walking Surfaces: 120 pounds per linear foot.
3. Structural Supports Sway Parallel to Seats: 24 pounds per linear foot of row combined with Uniformly Live Load.
4. Structural Supports Sway Perpendicular to Seats: 10 pounds per linear foot of row combined with Uniformly Live Load.

C. Dimensions:
1. Overall dimensions as indicated on Drawings.
2. Other dimensions unless indicated otherwise on Drawings:
   a. Rise Per Row:
      1) 11-1/2 inches.
   b. Row Depth:
      1) 26 inches from seat front to next seat front (13.2 inches minimum clear aisle required per IBC 2018 - Section 1028).
   c. Seat Height Above Tread: 6-1/2 inches.

D. Structural Supports: Steel or aluminum; wheeled carriages supporting each tier separately, with moving parts permanently lubricated and metal parts cushioned to prevent metal-to-metal contact during operation.
1. Design each row carriage so that it will individually support the design loads and is self-supporting when fully assembled without dependence on platform panels or boards, seats, or fascia.
2. Vertical columns and deck supports.
3. Stabilized by sway braces attached to the vertical columns and steel risers for strength and resistance to movement. Sway braces fabricated from steel to resist compression and tension forces created when the bleachers are loaded.
4. Vertical columns, minimum 2 x 3 inches closed seam, rectangular structural steel tubing. Post size as required for row height and load bearing requirements.

5. Rigid deck support brackets to prevent sagging and binding during operation.
6. All deck supports are to incorporate rollers for efficient operation and deck stability.
7. Continuous structural galvanized steel nose-beam to which the seat surface is attached for a uniform understructure providing strength and continuous support for the plywood deck.
8. Low friction flexible rod sliding system with positive engagement of vertical supports without binding. Provide smooth operation over floor. Maintain proper vertical column spacing and eliminate racking damage.
9. Welding: In accordance with AWS D1.1/D1.1M and AWS D1.3/D1.3M.
10. Bolting: Use lock-washers or locknuts.
11. Wheels: Minimum 5 inches diameter by 1-1/8 inch wide, with non-marring heavy duty composition rubber tires; ball, roller, or oil-impregnated metal bearings; minimum of 2 wheels at each floor support.
12. Finish: Manufacturer's standard enamel or powder coating. Color, black.
13. Row Locking: Automatically mechanically lock each carriage to adjacent carriages when fully extended.
14. Unlocking (Motorized Operation): Automatically unlock all rows before engaging retraction mechanism.
15. Rollers On Each Deck Support: Provide nylon rollers at the top of every deck to reduce friction, provide smooth and quiet operation, provide deck stability, and to eliminate steel-to-steel contact that might hinder the operation of the bleacher.
16. Nose-beam splice, 4-bolt pattern, minimum.
17. Section splice, 8-bolt pattern joint connections, minimum.

E. Motor Operation:
1. Integral Power: Integral automatic electro mechanical powered frame propulsion system, to open and close telescopic seating. Integral Power and Control System shall be Underwriters Laboratories, Inc. (UL) approved and listed.
2. Operation with removable pendant control unit which plugs into seating bank for operator management of stop, start, forward, and reverse control of the power operation.
3. Each Powered Frame unit consists of output shaft gear reducer. Reducers shall be fitted with 3 phase induction motors which will provide an average operating speed of 46 fpm.
4. Operating Loads: Each Powered Frame is to provide 220 lbs pull force which equals approximately 28 psi lateral force on the floor.
5. Limit Switches: Provide both open and closed limit switches for the integral power system. The limit switches will automatically stop integral power operation when seating has reached the fully extended or closed position.
6. Motion Monitor: Provide flashing light with self-contained warning horn rated at 85 db at 10 feet mounted under telescopic seating for audio and visual warning during integral power operation.
7. Electrical: Each power frame unit is power operated by a 1/2 horsepower, 1725 RPM, 208 Volts, 60 Hz., three phase, 1.25 service factor motor.
8. Provide access to motor from front side of bleachers; a hinged front skirt or hinged section at least 30 inches (760 mm) wide is acceptable.

2.3 MATERIALS

A. Plywood: NIST PS 1, A-C Exterior Grade.

B. Structural Steel Shapes, Plates and Bars: ASTM A36/A36M.

C. Structural Tubing: ASTM A500/A500M, Grade B.

D. Polyethylene Plastic: ASTM D1248, Type III, Class B.

2.4 SEAT AND PLATFORM COMPONENTS

A. Seat/Fascia Assembly: Continuous, molded UV-stabilized high-density polyethylene plastic, seat minimum 1 inch thick, textured finish, homogeneous color throughout, color as selected from manufacturer's full range color selection; independently removable with tongue-and-groove or rabbeted interlock at end joints; stain and warp resistant.
   1. Basis of Design:
      a. Hussey XC10.
      b. Color: To be selected by Architect from manufacturer’s full range of colors.
   2. Attaching clamp for a steel-to-steel connection of the module to the 14-gauge galvanized steel nose beam.
   3. Each module to incorporate full 1/2 inch perimeter interlocks to secure one module to the next for increased strength.
      a. Minimum five (5) vertical and two (2) lateral ribs inside each module for strength.
      b. 360 degree interlocking connection.
   4. 18 inches wide interlocking seat module with seat height of 18-1/2 inches.
   5. Seat depth as required by applicable codes and as indicated herein and on Drawings.
   6. Shape: Ergonomically contoured, with internal ribs spaced for natural flexibility; rear edge cantilevered to provide toe room of not less than 3 inches; no openings to trap debris.
   7. Fire Retardance: Self-ignition temperature of 650 degrees F (343 degrees C) or greater when tested in accordance with ASTM D1929; smoke developed index of 450 or less, when tested in accordance with ASTM E84, or 75 or less when tested in thickness intended for use in accordance with ASTM D2843; and burning extent of 1 inch or less when tested in thickness intended for use in accordance with ASTM D635.
   8. Provide end caps of same material and finish on each exposed end.
   9. Supports: Internal steel reinforcement of each seat segment bolted to platform nose member; minimum two bolts per segment.
   10. Seat Numbers: Provide each plastic seat module with a 1-3/4 x 1-1/4 inch oval etched polycarbonate plate. Provide black numerals on plate fitted in a vandal resistant recess.
   11. Row Letters: Provide at each row end of plastic seat a 1-3/4 x 1-1/4 inch oval etched polycarbonate plate with black numerals. Plates to be fitted flush in vandal resistant end cap recess.

B. Platform, Tread, and Step Structure: Plywood continuously supported on front and rear and with aluminum "H" Beam at every plywood joint for continuous support from rear riser to nose-beam.
   1. Plywood: PS 1, 5-ply southern pine or polyethylene-overlaid Douglas Fir or Southern Pine, Grade A-C.
   2. Plywood Thickness: 5/8 inch, minimum.
   3. Platform (Deck) Plywood Finish: High gloss clear urethane, both sides.
   4. Front (Nose), Rear, and Intermediate Supports: Steel channel or tube, hot-dipped galvanized.
   5. Nosings: Formed steel, minimum, G60/Z275 hot-dipped galvanized.
   6. Rear Riser: Continuous metal sheet, formed to conceal vertical void from bottom of seat modules to platform (deck). Form bottom edge to continuously receive edge of platform (deck) edge and conceal joint. Form top edge to continuously conceal undercarriage supports for upper platform (deck) framing, but allow continuous access joint for removal of seat modules. Minimum 14-gauge, grade 50, galvanized steel sheet.

7. Provide end caps of same material and finish on each exposed end.
8. At aisles provide permanently attached intermediate steps of same construction and finish.
    a. Designed to comply with applicable code requirements, providing an equal depth and height foot surface between rows.
    b. Provide safety abrasive tread on all steps with 2 inches wide contrasting stripe at nosing.
9. At bottom of aisles provide step in front of first riser, hinged to first platform to fold for storage.

2.5 HANDRAILS AND RAILINGS

A. Provide the following railings:
1. Aisle Handrails: Self-Storing Aisle Rails (SSAR). 36 inches high, permanently bolted in position and automatically store in the deck, ensuring that the rails are in place at all times for spectator safety.
2. End of Row Guardrails: 42 inches high and required on open ends of telescopic seating systems. Self-Storing End Rails designed and tested to meet all current national building code requirements.
3. Top Row Rear Guardrail: Only required in such conditions where the top row does not abutt to a wall that is a minimum height of 48 inches above the top row. Non-removable self-storing, mounted behind rear seat with tubular supports, running full width of section.
4. Wheelchair Spaces Guardrails: Removable; 42 inches high.
5. Height: 42 inches (1067 mm) above adjacent platform or tread.
6. Removable Railings: Provide steel post sockets attached to platform supports.

B. Engineer handrail, railing and guardrail systems to withstand the following loads:
1. Handrailings, Posts and Supports:
    a. Concentrated Load: 200 pounds applied at any point and in any direction.
    b. Uniform Load: 50 pounds per foot applied in any direction.
2. Guardrailings, Posts and Supports:
    a. Concentrated Load: 200 pounds applied at any point and in any direction along top rail.
    b. Uniform Load: 50 pounds per foot applied horizontally at top rail and a simultaneous uniform load of 100 pounds per foot applied vertically downward.
    c. Guardrailings system shall not allow a 4 inches diameter sphere to pass through.

C. Railing Construction: Round steel or aluminum pipe or tube, with formed elbows at corners and caps at ends of straight runs.
1. Aluminum: 1.66 inches minimum outside diameter; textured powder coat epoxy finish.
2. Steel: 1-1/2 inch minimum outside diameter, with 11 gage, 0.12 inch minimum wall thickness; textured powder coat epoxy finish.

2.6 ACCESSORIES

A. Fillers and Closures:
1. Ends of Retracted Units: Plywood panels, finished to match platforms.
2. Top Row: Provide seat level rear filler panels to close openings between top row seat and wall; finish to match platforms.
3. Sides of Extended Units: Laminated Vinyl Side Curtains to close-off the ends of the bleachers.
    a. Grommets at every hanger location, chain weight bottom hem.

b. Color as selected by Architect from manufacturer's full range of colors.

B. Motion Monitor: Strobe light and warning horn rated at 150 dB, both of which operate continuously during movement of any section of bleachers; mount strobe light where it is clearly visible to entire bleacher installation.

C. Semi-permanent Media Platform: Wall mounted platform that allows for the bleachers to remain fully functional with the platform in place.

D. Fasteners: Provide hardware and fasteners in accordance with manufacturer's recommendations.

E. Anchorage: Provide anchorage hardware in accordance with manufacturer's recommendations and as indicated on Drawings.

F. Provide manufacturer's tool (device) used as an operating handle for manually extending and retracting the bleachers. Provide total number of tools needed for easy operation, but no less than four (4) such devices.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 73 00 - Execution: Verification of existing conditions before starting work.

B. Verify that field measurements are consistent with those on the shop drawings.

C. Verify that electrical rough-ins have been installed and are accessible.

D. Do not begin installation until substrates have been properly prepared and area has been cleared of obstructions.

E. Verify that flooring support and solid blocking has been stalled where required.

F. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Section 01 73 00 - Execution: Prepare field conditions and existing construction for installation of work of this Section. Prepare materials to be installed and equipment used during installation.

B. Clean surfaces thoroughly prior to installation.

C. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Section 01 73 00 - Execution: Related to installation of Work.

B. Install in accordance with manufacturer's instructions.

C. Do not field cut or alter seats, fascia, or structural members without approval.

D. Provide manufacturer's field representative to inspect completed installation.

3.4 ADJUSTING

A. Section 01 73 00 - Execution: Starting, testing, adjusting, and balancing.

B. Set limit switches to provide fully closed and fully extended positions.

C. Lubricate, test, and adjust each moving assembly to ensure proper operation in compliance with manufacturer's recommendations.

3.5 CLEANING

A. Section 01 73 00 - Execution and Section 01 77 00 - Closeout Procedures: Related to cleaning.

B. Clean and remove excess construction debris from area. Coordinate cleaning of flooring with the flooring installer to avoid improper or damaging cleaning efforts.

C. Clean exposed and semi-exposed assembly surfaces.

D. Touch up finishes on damaged or soiled areas.

3.6 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 73 00 - Execution: Protecting installed construction.

B. Protect installed products until completion of project.

C. Touch-up, repair, or replace damaged products.

3.7 DEMONSTRATION AND TRAINING

A. Section 01 79 00 - Demonstration and Training.

B. Provide manufacturer's field representative to provide training and demonstration.
   1. Location: On site using installed equipment.
   2. Time: As agreed between Owner and Contractor.

C. Train Owner’s representative on the operation and safety features for fully extending and retracting bleachers.

D. Identify service requirements and serviceable parts.

E. Identify remedial procedures for common operational errors such as jammed mechanisms.

END OF SECTION

Construction Documents 6/12/24

SECTION 14 21 23.16

ELECTRIC TRACTION PASSENGER ELEVATORS - MRL

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Electric traction passenger elevators; machine room-less (MRL).

B. Related Requirements:
   1. Division 03 - Concrete: Cast-in-place concrete.
   2. Division 04 - Masonry: Masonry, mortaring, and grouting.
   3. Division 05 - Metals: Structural steel, metal fabrications, and metal fabrications.
   4. Division 07 - Thermal and Moisture Protection: Waterproofing.
   5. Division 09 - Finishes: Gypsum shaft walls, finish flooring, and field applied painting and coatings.
   6. Division 23 - Mechanical (HVAC): Fans and ventilation and temperature controls.
   7. Division 26 - Electrical: Equipment wiring systems.
      a. Electrical characteristics and wiring connections.
      b. Electrical service for elevator equipment operations and convenience outlets.
      c. Lighting in elevator pit and hoistway.
      d. Electrical wiring conduits.
   8. Division 28 - Electronic Safety and Security:
      a. Fire and smoke detectors and interconnecting devices.
      b. Fire alarm signal lines to elevator controller cabinet.
   9. Division 33 - Utilities: Storm drainage piping for pit drainage.

1.2 REFERENCE STANDARDS

A. Americans with Disabilities Act (ADA):
   1. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; Current Edition.

B. Accredited Elevator/Escalator Certifying Organization (AECO).

C. American Society of Mechanical Engineers (ASME):
   1. 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. International Organization for Standardization (ISO):
   1. ISO 9001 - Quality Management Systems - Requirements; 2015, 5th Edition.

E. Intertek Testing Services (ITS):
   1. ITS (DIR) - Directory of Listed Products; Current Edition.

F. National Fire Protection Association (NFPA):
   1. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
   2. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2022.

G. Underwriters Laboratories Inc. (UL):
   1. UL (DIR) - Online Certification Directory; Current Edition.
   2. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Section 01 30 00 - Administrative Requirements: Requirements for coordination.
   2. Coordinate elevator work with work of other trades, for proper time and sequence to avoid construction delays.
   3. Coordinate requirements for anchoring the work to building structural elements.
   4. Coordinate the work with the installation of roofing system for weathertight condition.
   5. Coordinate installation of electrical components for connectivity to power, emergency power, and security and fire alarm monitoring panel.

B. Pre-Installation Meetings:
   1. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.
   2. Convene minimum one week prior to commencing work of this Section. Review the work requirements, application procedures, quality control, testing and inspection and production schedule.
   3. Require attendance of parties directly affecting work of this Section, including Contractor and elevator manufacturer/installer.
   4. Review utility requirements, examination, installation, field quality control, adjusting, cleaning, protection, and coordination with other work.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit manufacturer/installer's product data, including,
   1. Descriptive brochures or detail drawings of car and hall fixtures, cab ceilings, and product features.
   2. Power Information: Horsepower, starting current, running current, machine and control heat release, and electrical requirements.

C. Shop Drawings: Submit manufacturer/installer's shop drawings, including plans, elevations, sections, and details, indicating location of equipment, loads, dimensions, tolerances, materials, components, fabrication, fasteners, hardware, finish, options, accessories, and other information to render totally functional elevators.

D. Seismic Design: Submit applicable seismic design data; certified by a licensed Professional Structural Engineer.

E. Samples: Submit selection charts and actual samples of manufacturer/installer's full range of colors and finishes for selection by Architect.

F. Designer's Qualification Statement.

G. Manufacturer/Installer's Qualification Statement.

H. Sample Documents: Indicating compliance with indicated requirements.
   1. Warranty Sample.
   2. Maintenance Service Agreement.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 77 00 - Closeout Procedures.

B. Inspection and Testing: Submit documentation indicating completion and compliance.

C. Operation and Maintenance Manual: Submit manufacturer/installer's operation and maintenance manual; including operation, maintenance, adjustment, and cleaning instructions; trouble shooting guide; renewal parts catalogs; and electrical wiring diagrams.

D. Warranty Documentation: Submit manufacturer/installer's warranty with forms acceptable to Owner and completed in Owner's name.

E. Maintenance Service Agreement: Submit manufacturer/installer's maintenance service agreement on forms acceptable to Owner and completed in Owner's name.

1.6 QUALITY ASSURANCE

A. Elevator components and system shall be installed by elevator manufacturer.

B. Designer Qualifications: Design guide rails, supports, and anchors under direct supervision of a licensed Professional Structural Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

C. Manufacturer/Installer's Qualifications: Specialize in manufacturing and installing elevator equipment, with a minimum of ten (10) years documented successful experience.

D. Inspection and Testing: Manufacturer/installer is to obtain and pay for all required inspections, tests, permits and fees for elevator installation. Arrange for inspections and make required tests.

E. Products Requiring Fire Resistance Rating: Listed and classified by ITS (DIR), UL (DIR), or testing agency acceptable to authorities having jurisdiction.

F. Products Requiring Electrical Connection: Listed and classified by UL (DIR) or testing agency acceptable to authorities having jurisdiction as suitable for the purpose indicated in construction documents.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Delivery: Deliver materials to site in manufacturer/installer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer/installer.

C. Storage: Store materials in clean, dry area indoors in accordance with manufacturer/installer's instructions.

D. Handling: Protect materials during handling and installation to prevent damage.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Requirements before, during, and after the work.

B. Provide permanent electrical power prior to start of installation.

C. Provide clear, rollable access to a 10 by 20 foot secure and dry storage area prior to delivery.

D. Provide a clean, dry, and complete hoistway along with temporary installation platform and all required OSHA compliant barricades prior to delivery.

1.9 WARRANTY

A. Section 01 77 00 - Closeout Procedures: Product warranties.

B. Manufacturer/installer shall guarantee materials and workmanship of equipment installed under these specifications and make good, defects not due to ordinary wear or to improper use, which may develop during the follow warranty period of completed work:

1. Warranty Period:
    a. One (1) year after date of Substantial Completion.

1.10 MAINTENANCE SERVICE AGREEMENT

A. Section 01 73 00 - Execution: Maintenance Service.

B. Services: Manufacturer/installer is to provide labor and parts for maintenance service, inspections, and callback service on each elevator system during the indicated warranty period. Manufacturer/installer is to coordinate service work directly with Owner as to not disrupt Owner's requirements for operation. Service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

C. Services include the following work and shall be provided by trained employees:
   1. Maintain elevator(s) in safe operational condition.
   2. Compliance with manufacturer/installer's recommended schedule for services.
   3. Compliance with ASME A17.1 and applicable code requirements.
   4. Periodic examinations and work including adjusting, greasing, oiling, and replacing parts, except parts damaged by accidents, vandalism, misuse, or negligence by parties other than manufacturer/installer.
   5. Remote Monitoring of Elevator Control System:
      a. Include built-in remote diagnostic module to relay constant status of elevators and control system to a 24-hour, 7-days-a-week central-monitoring facility.
      b. Remote Monitoring Device: Transmit current status information on elevators, including malfunctions, system errors, and shutdown.
   6. Manufacturer/installer is to absorb all costs associated with providing indicated services, except as follows:
      a. Should Owner require additional services, including emergency call-back service, to be performed on other than manufacturer/installer's regular working hours of regular working days, manufacturer/installer shall absorb straight-time labor and travel charges and Owner will compensate manufacturer/installer for overtime premium, at documented normal overtime premium billing rates.

PART 2 PRODUCTS

2.1 PERFORMANCE AND DESIGN REQUIREMENTS

A. ASME A17.1 shall govern, except where codes having legal jurisdiction include more rigid requirements or conflict with ASME A17.1.

B. Elevator shall follow design and manufacturing procedures certified in accordance with ISO 9001 to meet product and service requirements for quality assurance for new products.

C. Where product is in variance to the published ASME A17.1 model code, provide a 3rd party AECO certification demonstrating equivalent function, safety, and performance.

D. Motors, Controllers, Controls, Buttons, Wiring, Devices, and Indicators: Comply with NFPA 70 requirements, and requirements indicated in Division 26 - Electrical and Division 28 - Electronic Safety and Security.

E. Guide Rails, Cables, Counterweights, Sheaves, Buffers, Attachment Brackets and Anchors: Design criteria for components includes safety factors in accordance with applicable requirements of Elevator Code, ASME A17.1.

F. Arrange elevator components, controls, and machinery in spaces allowing for inspection, maintenance, replacement, and repairs with minimal disturbance to other equipment and components.

G. Where permitted by code, provide all elevator equipment including controls, drives, transformers, and rescue features within the elevator hoistway.

H. Elevator design, clearances, construction, workmanship, materials, and installation, unless specified otherwise, shall be in accordance with ASME A17.1, ADA Standard for accessibility, and applicable codes having legal jurisdiction.

2.2 MANUFACTURER/INSTALLER

A. Manufacturers/Installers:
1. Otis Elevator Company.
2. Schindler Elevator Corporation.
3. ThyssenKrupp Elevator.
4. Substitutions: Section 01 60 00 - Product Requirements.

B. Basis of Design: Schindler - 3100 Gearless Electric Traction Passenger Elevator.

2.3 ELEVATOR SYSTEM SUMMARY

A. Elevator Equipment Summary:
1. Application: Machine Room-Less (MRL).
2. Counterweight Location: Side.
3. Machine Location: Top of hoistway mounted on car and counterweight guide rails.
4. Control Space Location: Top landing entrance frame or entrance frame at one floor below the top landing.
5. Service: General purpose passenger.
6. Quantity: 1 unit.
7. Net Capacity: 3,500 lbs.
8. Travel Speed: 100 fpm.
9. Travel Distance: As indicated on Drawings.
10. Landings: 2.
11. Front Openings: 2.
12. Rear Openings: None.
13. Rear Door Hand: N/A.
14. Operation: Microprocessor single car automatic operation.
15. Clear Inside Dimensions: 6'-10" W by 5'-7" D.
16. Cab Height: 7'-9".
17. Guide Rails: Equivalent to 12 lb. per foot.
18. Entrance Type and Width: Doors to be two-speed side opening 3'-6" W by 7'-0" H.
19. Entrance Height: 7'-0".
20. Power Supply: 460 Volts, 3 Phase, 60 Hz.

B. Performance:
1. Car Speed: Maintain contract speed under any loading condition or direction of travel; variance range, 10 percent less to 5 percent greater than contract speed.
2. Car Capacity: Safely lower, stop and hold up to 125 percent of rated load per code.

C. Ride Quality:
1. Vertical Vibration (maximum): 25 mg.
2. Horizontal Vibration (maximum): 15 mg.
3. Vertical Jerk (maximum): 2 ft/sec^3.
4. Acceleration (maximum): 1.6 ft/sec^2.
5. In Car Noise: 53-60 dB(A).
6. Stopping Accuracy: ±5mm.
7. Starts per hour (maximum): 180.

D. Elevator Operation:

1. Simplex Collective Operation: Using a microprocessor based controller, operation shall be automatic by means of the car and hall buttons. When all calls have been answered, the car shall park at the last landing served.
2. Group Automatic Operation with Demand-Based Dispatching: Provide reprogrammable group automatic system that assigns cars to hall calls based on a dispatching algorithm designed to minimize passenger waiting time.

E. Operating Features - Standard:
1. Door Light Curtain Protection.
2. Static AC Drive.
3. Phase Monitor Relay.
4. Cab Overload with Indicator.
5. Load-Weighing.
6. Central Alarm.
7. Remote Monitoring.
8. Firefighter's Operation.
9. Automatic Evacuation.
   a. When the main line power is lost for longer than 5 seconds the emergency battery power supply provides power automatically to the elevator controller. If the car is at a floor when the power fails, it remains at that floor, opens its doors, and shuts down. If the car is between floors, it is raised or lowered to the first available landing, opens it doors, and shuts down.
10. Independent Service.

2.4 CONTROL COMPONENTS AND CONTROL SPACE

A. Controller: Provide microprocessor based control system to perform all the functions of safe elevator operation, as well as perform car and group operational control.
1. All high voltage (110v or above) contact points inside the inspection and test panel to be protected from accidental contact in a situation where the access panels are open.
2. Controller is to be distributed throughout the elevator system located in the overhead, cab and inspection and test panel. The inverter is to be mounted in the overhead adjacent to the hoist machine and an inspection and test panel is to be located in the door jamb at the top floor or one floor below the top floor. No elevator equipment mechanical rooms or closets are to be required.
3. Provide multi-bus control architecture to reduce cabling, material, and waste.

B. Drive: Provide a Variable Voltage Variable Frequency AC Closed Loop drive system. Provide stable start without high peak current, quickly reaching a low energy consumption level.

C. Inspection and Test Panel: Integrated control equipment, main inspection, and test panel in door frame at top level served or at one floor below the top level served.

2.5 HOISTWAY COMPONENTS

A. Machine:
1. Gearless asynchronous AC motor with integral drive sheave, service, and emergency brakes.
2. Design machine to enable direct power transfer, thereby avoiding loss of power.
3. Design machine to be compact, lightweight, and durable to optimize material usage and save space.
4. Mount to structural support channels on top of guide rail system as applicable in hoistway overhead.

B. Governor:

1. Tension type over-speed governor with remote manual reset.
2. Mount to structural support channels as applicable in hoistway overhead.

C. Buffers, Car, and Counterweight: Compression spring type buffers to meet code.

D. Hoistway Operating Devices:
1. Emergency Stop switch in the pit.
2. Terminal stopping switches.
3. Emergency stop switch on the machine.

E. Positioning System: System consisting of proximity sensors and door zone vanes.

F. Guide Rails and Attachments: Provide Tee-section steel rails with brackets and fasteners. Side counterweight arrangements shall have a dual purpose bracket that combines both counterweight guide rails, and one of the car guide rails to building fastening.

G. Suspension System: Non circular Elastomeric coated suspension media with high tensile grade steel cords.

H. Governor rope: Steel wire rope with 6 mm diameter.

2.6 HOISTWAY ENTRANCES

A. Hoistway Doors and Frames:
1. UL rated with required fire rating.
2. Doors: Rigid flush panel construction with reinforcement ribs.
3. Frames: Securely fasten at corners to form unit frame. Frames shall be bolted.

B. Finishes:
1. Corridor Frames:
   a. Stainless Steel:
      1) All floors.
2. Doors:
   a. Stainless Steel:
      1) All floors.
3. Sills: Aluminum - All Floors.

C. Entrance Markings and Jamb Plates: Provide ADA compliant entrance jamb tactile markings on both jambs, at all floors.
1. Plate Mounting: Comply with ADA requirements and Drawings.

2.7 ELEVATOR CAR COMPONENTS

A. Car Frame and Safety: Provide car frame with adequate bracing to support the platform and car enclosure. The safety shall be integral to the car frame and shall be flexible guide clamp type.

B. Platform: Provide platform of steel construction with plywood subfloor and aluminum threshold.

C. Car Guides: Provide sliding guide shoes mounted to top and bottom of both car and counterweight frame. Arrange each guide shoe assembly to maintain constant contact on the rail surfaces. Provide retainers in areas with Seismic design requirements.

D. Provide central guiding system to reduce mechanical friction and energy consumption.

E. Steel Cab:
1. Fire Rating: Provide Class B fire rating for cab, or Class A fire rating where required by local Code.

2. Low-Emitting Materials: Comply with LEED Indoor Environmental Quality requirements for materials on walls, ceiling, and subflooring.
3. Car Wall Finish: #4 Stainless Steel Finish selected from manufacturer's standard selections.
4. Base And Frieze: Aluminum.
5. Car Front Finish: Brushed stainless steel.
6. Car Door Finish: Brushed stainless steel.
7. Ceiling: #4 stainless steel.
8. Lighting: Six (6) recessed LED light fixtures.
9. Handrails: Round bushed stainless steel with return end.
   a. Locations: Rear and side walls.
10. Flooring: Not to exceed 3/8 inch finished depth.
11. Ventilation: Provide one-speed fan in canopy.
12. Emergency Car Lighting: Provide an emergency power unit employing a 12 volt sealed rechargeable battery and static circuits to illuminate the elevator car and provide current to the alarm bell in the event of building power failure.
13. Emergency Siren: Provide siren mounted on top of the car that is activated when the Alarm button in the car operating panel is engaged.
14. Emergency Exit Switch: Provide an electrical contact to open the safety circuit when the emergency car top exit is opened. When the exit door is opened, the top exit switch shall signal the control and the car will be unable to move.
15. Emergency Exit Lock: Provide an emergency exit lock where required by local code.
16. Emergency Exit Guard: Provide emergency exit guard on top of car when required for hoistway wall to platform clearance exceeds 12 inches or for multiple cars in hoistway.

2.8 DOOR OPERATOR AND REOPENING DEVICES

A. Door Operator: Provide a closed loop VVVF high performance door operator with frequency controlled drive for fast and reliable operation to open and close the car and hoistway doors simultaneously.

B. In case of interruption or failure of electric power, the doors can be readily opened by hand from within the car, in accordance with applicable code. Provide emergency devices and keys for opening doors from the landing as required by local code.

C. Doors shall open automatically when the car has arrived at or is leveling at the respective landings. Doors shall close after a predetermined time interval or immediately upon pressing of a car button. Provide door open button in the car operating panel. Momentary pressing of this button shall reopen the doors and reset the time interval.

D. Provide door hangers and tracks for each car and hoistway door. Contour tracks to match the hanger sheaves. Design hangers for power operation with provisions for vertical and lateral adjustment. Hanger sheaves shall have polyurethane tires and pre-lubricated sealed for life bearings.

E. Electronic Door Safety Device: Equip car doors with concealed transmitter and receiver infrared beam devices to detect presence of object in process of passing through hoistway entrance and car doorway (light curtain device).
1. Use multi-beam scanning without moving parts to detect obstructions in door opening.
2. Detector Device: Prevent doors from closing, or if they have already started closing, cause doors to reopen and remain open while object is within detection zone.
3. Horizontal Beams: Minimum of 33 infra-red beams to fill doorway from ground level to a height of 6 feet.

2.9 SIGNAL DEVICES AND FIXTURES

A. Car Operating Panel: Provide a car operating panel with all push buttons, key switches, and message indicators for elevator operation.
   1. Full height car operating panel shall be surface-mounted on front return.
   2. Comply with handicap requirements.
   3. Push Buttons: Mechanical, illuminating using long-lasting LEDs for each floor served.
   4. Emergency Buttons: Provide in accordance with code. Emergency alarm button, door open and door close buttons.

B. Features of the Car Operating Panel Shall Include:
   1. Audible chime to signal that the car is either stopping at or passing a floor served by the elevator.
   2. Raised markings and Braille provided to the left hand side of each push button.
   3. Car Lantern: Provide LED illuminated car lantern with direction arrows to comply with local code when hall lanterns are not provided.
   4. Door open and close push buttons.
   5. Firefighter's hat and Phase 2 Key-switch.
   6. Inspection key-switch.
   7. Key-switch for optional Independent Service Operation.
   8. Illuminated alarm button with raised marking.
   9. Elevator Data Plate marked with elevator capacity and car number.
   10. Help Button: Activation of help button will initiate two-way communication between car and a location inside the building, switching over to alternate location if call is unanswered, where personnel are available to take the appropriate action. Visual indicators are provided for call initiation and call acknowledgement.
   11. Certificate Frame.

C. Hall Fixtures: Provide hall fixtures with necessary push buttons and key switches for elevator operation.
   1. Push buttons: Metallic tactile push buttons, up button and down button at intermediate floors, single button at each terminal floor.
   2. Height: Comply with handicap requirements.
   3. Illumination: Long-lasting, low power LED lamps.

D. Hall Lanterns and Position Indicators.
   1. LED illuminated direction arrows with audible and visible call acknowledgement.

E. Hoistway access switches: Provide key-switch at top and/or bottom floor in entrance jamb as required by local code.

F. Firefighter's Phase 1 Service: Key switch in brushed stainless steel cover plate.

G. Fixture Cover Plates: For push buttons, hall lanterns and position indicators, resistant white back-printed glass, no screws required for mounting. Provide stainless steel cover plates for Firefighter's Phase I switch and hoistway access switches, with tamper resistant screws in same finish.

H. Mounting: Hall fixtures to be mounted in entrance frames.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 73 00 - Execution: Verification of existing conditions before starting work.

B. Examine hoistways, hoistway openings, and pits before starting elevator installation.

C. Verify hoistway, pit, overhead, and openings are of correct size, within tolerances, and are ready for work of this section.

D. Verify walls are plumb where openings occur and ready for entrance sill installation. Traditional sill angle or concrete sill support shall not be required.

E. Verify hoistway is clear and plumb, with variations not to exceed -0 to +1 inch at any point. Verify projections greater than 4 inches must be beveled not less than 75 degrees from horizontal. No negative tolerance is permitted for minimum hoistway dimensions.

F. Verify minimum 2-hour fire-resistance rating of hatch walls.

G. Notify Architect in writing of dimensional discrepancies or other conditions detrimental to proper installation or performance of elevators.

H. Do not proceed with elevator installation until unsatisfactory conditions have been corrected in a manner acceptable to manufacturer/installer.

3.2 PREPARATION

A. Section 01 73 00 - Execution: Prepare field conditions and existing construction for installation of work of this Section.

B. Prepare materials to be installed and equipment to be used during installation.

3.3 INSTALLATION

A. Section 01 73 00 - Execution: Related to installation of Work.

B. Install elevators in accordance with manufacturer/installer's instructions and ASME A17.1.

C. Set entrances in vertical alignment with car openings and aligned with plumb hoistway lines.

3.4 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Monitor quality of installation, inspection, and testing.

B. Perform tests of elevator as required by ASME A17.1 and governing codes.

3.5 ADJUSTING

A. Section 01 73 00 - Execution: Starting, testing, adjusting, and balancing.

B. Adjust elevators for proper operation in accordance with manufacturer/installer's instructions.

C. Adjust elevators for smooth acceleration and deceleration of car so not to cause passenger discomfort.

D. Adjust doors to prevent opening of doors at landing on corridor side, unless car is at rest at that landing, or is in leveling zone and stopping at that landing.

E. Adjust automatic floor leveling feature at each floor to within 1/4 inch of landing.

F. Repair minor damages to finish in accordance with manufacturer/installer's instructions and as approved by Architect.

G. Remove and replace damaged components that cannot be successfully repaired as determined by Architect.

3.6 CLEANING

A. Section 01 73 00 - Execution and Section 01 77 00 - Closeout Procedures:

B. Clean installed work in accordance with manufacturer's recommendations including cleaning procedures and materials.

C. Do not use harsh cleaning materials or methods that could damage finish.

3.7 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 73 00 - Execution: Protecting installed construction.

B. Protect installed construction from damage and unauthorized tampering.

3.8 DEMONSTRATION AND TRAINING

A. Section 01 79 00 - Demonstration and Training: Provide demonstration and training to the Owner regarding operation and maintenance of components of the installed Work.

B. Include demonstration and training for emergency, alarms, and reset operations.

END OF SECTION

Construction Documents 6/12/24

SECTION 21 05 00

FIRE PROTECTION SYSTEM GENERAL

PART 1 - GENERAL

1.1 SCOPE

A. Design, fabricate, install, and secure required approvals for a complete fire protection automatic sprinkler [and standpipe] system where shown on the Drawings, as specified herein, and as needed for a complete and proper installation in accordance with pertinent requirements of NFPA 13 and local governmental agencies having jurisdiction.

B. Work includes providing design services; furnishing all labor, material, equipment and installation as necessary and reasonably incidental to the proper completion and proper operation of the fire protection systems. The work shall consist of but shall not necessarily be limited to the following:

1. Automatic wet-pipe sprinkler system as specified in Section 21 13 13.
2. Automatic dry-pipe sprinkler system as specified in Section 21 13 16.
3. Fire Pump system as specified in Section 21 30 00.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 (General Requirements) sections of the Project Manual apply to this Section.

B. The General Conditions shall be carefully examined before proposals for any work are submitted. Division 21 shall not be interpreted as waiving or overruling any requirements expressed in the General Conditions unless Division 21 specifications contain statements more definitive or more restrictive.

1.3 DEFINITIONS

A. Words and phrases used throughout the Contract Documents shall be interpreted as indicated below:

1. Construction Documents – the basis for the work. It includes both the Drawings (plans) and Project Manual (specifications).

2. Contractor – The person or organization awarded the contract for fire protection design and construction services.

   In the case of a construction project administered as a multiple-prime contract, the term shall be further defined as the Contractor holding a prime contract for fire protection design and construction work.

The terms "Fire Protection Contractor" and "Sprinkler Contractor" may be used interchangeably with the term Contractor.

3. Provide – To furnish and install materials, equipment or systems.

4. Submittals – Submittals shall include Manufacturer's Catalog Data, Shop Drawings, Calculations, Certificates of Compliance, Testing Reports, Samples, and Operation and Maintenance Manuals.

5. Professional – The Architect and/or Engineer of record.

6. Work By Others – Work provided by a person or organization other than the Contractor.

1.4 CODES, REFERENCES, AND STANDARDS

A. The Contractor shall comply with all laws, ordinances, and regulations of all Authorities Having Jurisdiction, including those of all applicable City, County, State, Federal and Public Utility entities. All licenses, permits, fees, connection fees, tapping fees, inspection fees, etc., shall be obtained by the Contractor and the cost shall be included in the Contract price.

B. The minimum standard of work under this contract shall be in accordance with the following model building codes and standards:

1. International Code Council (ICC)

   a. International Building Code with North Carolina Amendments
   b. International Fire Prevention Code with North Carolina Amendments

2. National Fire Protection Association

   a. NFPA 13 – Standard for the Installation of Sprinkler Systems
   b. NFPA 20 – Standard for the Installation of Centrifugal Fire Pumps
   c. NFPA 24 – Standard for the Installation of Private Fire Service Mains and Their Appurtenances
   d. NFPA 70 – National Electric Code

C. Other publications listed throughout Division 22 form a part of this specification to the extent referenced. All publications shall be the latest edition as adopted by the Authority Having Jurisdiction. The publications are referred to in the text by basic designation only.

1.5 QUALITY ASSURANCE, WORKMANSHIP AND COORDINATION

A. The Contractor must coordinate his work with that of the other trades so that all work will be performed in an orderly manner and with the least possible interference. Where coordination with other trades is required, the Professional shall make the final decision regarding changes to be made in the work.

B. The Contractor must thoroughly familiarize himself with all specifications and drawings for the project so that he clearly understands his responsibility in relationship to the work to be performed. The Contractor must plan and perform his work to permit the use of the building as soon as possible.

1. Sprinklers shall be referred to on drawings, submittals, and other documentation, by the sprinkler identification or model number as specifically published in the appropriate agency listing or approval. Trade names or other abbreviated designations shall not be allowed.

C. The Contractor shall guarantee the workmanship, materials and equipment, furnished against defects, leaks, performance and non-operation for a period of one (1) year after the date of final acceptance. Defective workmanship shall be construed as meaning defective materials and unsatisfactory installation and not intended to apply to ordinary wear and tear. The Contractor shall pay for any repairs or replacements caused by defective workmanship as construed herein within the period covered by the Guarantee, including all incidental work required to correct the deficiency.

D. The Contractor shall expressly and completely follow all manufacturers' instructions required for validation of the manufacturer's warranty agreement including but not limited to service, maintenance and adjustments of the equipment.

E. The Contractor will be held responsible for the proper installation of all materials and equipment required for a complete installation within the intent and meaning of the Contract Documents.

1. All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.

2. All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability.

F. The grooved coupling manufacturer's factory trained representative shall provide on-site training for contractor's field personnel in the use of grooving tools and installation of grooved joint products. The representative shall periodically visit the jobsite and review contractor is following best recommended practices in grooved product installation. (A distributor's representative is not considered qualified to conduct the training or jobsite visit(s).)

1.6 PROJECT RECORD DRAWINGS

A. Deviations from the Contractor's approved Design and Fabrication Drawings necessary to coordinate the work with other trades, to conform to the building conditions or to conform to the rules and regulations of Authorities Having Jurisdiction shall be made only after obtaining written permission from the Professional.

B. The Contractor shall keep a record of construction changes and deviations from the original Design and Fabrication Drawings. All changes shall be recorded on a separate set of prints which shall be kept at the job site specifically for that purpose. The record shall be made immediately after the work is completed. Documentation shall include:

1. changes in pipe routing location
2. valve locations
3. Equipment locations, etc.
4. actual capacities and values of equipment provided as indicated in equipment schedules

C. The marked-up record set of drawings shall be submitted to the Professional for review and approval before final acceptance of the Fire Protection Contract work.

1.7 FIELD MEASUREMENTS

A. Before ordering any equipment and material, or performing any work, the Contractor shall verify all measurements and dimensions at the job site and shall be held responsible for the correctness of same.

B. No extra compensation will be allowed because differences between actual dimensions and measurements and those indicated on the Contractor's drawings.

1.8 PROTECTION OF SERVICES AND EQUIPMENT

A. The Contractor, at his own expense, shall repair, replace and maintain in service any utilities, facilities or services (underground, aboveground, interior or exterior) damaged, broken, or otherwise rendered inoperative during construction due to activities on the part of the Contractor. The method used by the Contractor in repairing, replacing or maintaining the services shall be approved by the Professional.

B. The Contractor shall protect, at his own expense, such of his work, materials or equipment that is subject to damage during the project duration. All openings into any piping, ducts or equipment must be securely covered, or otherwise protected, to prevent injury due to carelessly or maliciously dropped tools or materials, grit, dirt, or any foreign material. The Contractor shall be held responsible for all damage so done until his work is fully and finally accepted.

C. It shall be the responsibility of the Contractor to protect motors, pumps, electrical equipment, and all similar items of equipment from dirt, grime, plaster, water, etc. during all phases of construction. This protection shall be provided by covering equipment with transparent plastic sheeting and/or locating the materials and equipment in an area free from the elements.

1.9 INTERRUPTION OF SERVICES

A. The Contractor shall schedule his work to avoid any major interruption of any utility services.

B. Existing utilities serving facilities occupied and used by the Owner or others shall not be interrupted except when such interruptions have been authorized in writing by the Owner or the Professional. Interruptions shall occur only after acceptable temporary utility services have been provided. The Contractor shall provide a minimum of ten (10) working days notice to the Professional and receive written notice to proceed before interrupting any utility.

1.10 CLEANUP

A. The Contractor shall maintain buildings, grounds, and public properties free from accumulations of waste materials, debris and rubbish. At reasonable intervals during the progress of work, and when directed by the Owner's Authorized Representative, the site and public properties shall be cleaned and waste materials, debris and rubbish shall be disposed of in appropriate manner. The Contractor shall provide containers for collection of waste materials,

debris and rubbish. Waste materials, debris and rubbish shall be removed from the job site and legally disposed of at a landfill area in accordance with all applicable regulations. Burning or burying waste materials, debris or rubbish on project site shall not be permitted.

B. At the completion of the Project, remove waste materials, rubbish, tools, equipment, machinery, surplus materials, etc., and clean all sight-exposed fire protection fixtures and equipment. Remove grease, dust, dirt, stains, labels, fingerprints and other foreign materials from sight-exposed fire protection fixtures and equipment. Broom clean paved and concrete surfaces; rake clean other ground surfaces. Repair, patch and touch up marred surfaces to specified finish or to match adjacent surfaces.

1.11 SUBMITTALS

A. Submittals shall be in accordance with Division o1 of the Project Manual.

B. General

1. The Contractor shall provide to the Professional for review six (6) copies of required submittals, unless noted otherwise. All Catalog Data, Shop Drawings, Design (hydraulic) Calculations, and Certificates of Compliance shall be submitted as a single package. All delays to the job resulting from the Contractor's failure to provide submittals at one time will be the responsibility of the Contractor. Four (4) copies will be returned to the Contractor.
2. Submittals provided for review shall clearly and completely describe the specific product(s) they represent. Where differences exist between the item specified and that submitted for review, the submittal shall be highlighted.
3. Shop Drawings shall be prepared by a Certified NICET Level III technician. The plans should bear the signature, stamp and certificate number of the technician.
4. Submittals shall bear the review stamp of the Contractor. The review stamp of the Contractor shall be affixed to shop drawings to indicate:

    a. The Contractor has coordinated the electrical characteristics of the equipment.
    b. The Contractor has verified that the equipment submitted will physically fit into the space allocated with adequate clearances for maintenance, access, and egress requirements.
    c. The Contractor shall bear all associated costs that may accrue due to failure to completely represent a given product.

5. Material and equipment shown on the drawings or specified herein shall not be incorporated in the work of this Contract until shop drawings, hydraulic calculations, engineering data and catalog information have been reviewed and accepted by the Professional.

6. Grooved joint couplings and fittings shall be shown on drawings and product submittals, and shall be specifically identified with the applicable style or series designation.

C. Operation and Maintenance Manuals

1. Submit one electronic pdf sixty (60) days prior to operator training/pre-final inspection for review by the Professional.

2. Prepare binder covers with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS – FIRE PROTECTION SYSTEMS", title of project, and subject matter of binder when multiple binders are required.
3. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.
4. Contents: Prepare a Table of Contents for each volume, with each Product or system description identified type on thirty (30) pound white paper.

    a. Part 1: Directory, listing names, addresses, and telephone numbers of Contractor, Subcontractors, and equipment suppliers.
    b. Part 2: Operation and maintenance instructions arranged by system or process flow and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:

        1) Significant design criteria.
        2) List of equipment.
        3) Parts list for each component.
        4) Maintenance instructions for equipment and systems.
        5) Maintenance instructions for finishes, including recommended cleaning methods and materials and operating instructions.
        6) Special precautions identifying detrimental agents.
        7) Special Requirements of other sections of this specification noted to be included in the operating and maintenance manual.
        8) Original copy (reproductions will not be accepted) of NFPA 25 – Standard for the Inspection, Testing and Maintenance of Water-Based Fire Protection Systems.

    c. Part 3: Project documents and certificates, including the following:

        1) All approved Submittals
        2) Shop Drawings
        3) Hydraulic Calculations
        4) Certificates of Compliance
        5) Photocopies of warranties and bonds
        6) Material safety data sheets

5. Submit two (2) copies of completed volumes in final form fifteen (15) days prior to owner training. These copies will include Professional's previous review comments.

1.12 ELECTRICAL EQUIPMENT

A. The Contractor shall furnish all motors, combination starters/disconnects, overload protection and controls for equipment required to provide complete and workable systems, unless noted otherwise.

B. All motors, motor control equipment and wiring shall meet the requirements of the National Electric Code, and shall comply with the requirements of the Public Utility Company furnishing service and with the rules and regulations of all Authorities Having Jurisdiction.

C. The Contractor shall verify electrical characteristics at the site before ordering electrical equipment.

D. Motors under ½ (one-half) horsepower shall be 120 volts. Motors ½ (one-half) horsepower and over shall be 3 (three) phase. All motors to be 1750 revolutions per minute (rpm) unless noted otherwise. Combination motor starters shall be of the fused switch type complete with magnetic motor starter. Units shall be of the NEMA size and type applicable to motor size, with 3-pole overload. Overload elements and fuses shall be of the proper size to protect the motor. Unless noted otherwise, units shall be equipped with indicating lights, HAND-OFF-AUTOMATIC (HOA) selector switch, four (4) auxiliary contacts two (2) normally open (N.O.) and two (2) normally closed (N.C.) and fused control transformer to provide 120-volt control voltage. Fusible disconnect switch operating handles shall be interlocked with the door so that the door cannot be opened with the switch in the "ON" position, except through a hidden release mechanism. The operating handle shall be arranged for padlocking in the "OFF" position with up to three padlocks. Fuses shall be furnished by the Contractor as required to comply with NEC requirements. Where R type fuses are indicated, fuse holders shall be provided with rejection clips. Equipment shall be Square D, Allen-Bradley, or General Electric or accepted substitute, and shall be provided with a NEMA Type 1 enclosure, unless noted otherwise.

1.13 CONTROL WIRING

A. The Contractor shall provide all necessary control wiring and related conduit required for complete and workable systems.

B. All conduit and wiring shall be in accordance with the latest edition of the National Electrical Code. Installation of control wiring shall be performed in a neat and workmanlike manner by competent workmen. Workmanship shall be as specified in Division 16.

C. Control circuits shall be wired for 110-volt control, using fused individual control transformers. Circuits shall be fused and shall be interrupted when the disconnect device is opened.

1.14 CONCRETE

A. Concrete shall comply with Division 3 of the Project Manual.

B. Reinforcing shall conform to ASTM A-615, Grade 60. Concrete exposed to freezing and thawing, salts, sulfates and corrosion shall comply with International Building Code with North Carolina amendments.

C. All concrete shall be of minimum 3000 pounds per square inch (psi) strength in 28 (twenty-eight) days. All concrete shall be mixed by machine. No wet or moistened mixture containing cement shall remain unplaced for a period exceeding 30 (thirty) minutes and shall not be used after its initial set. Retempering after initial set is prohibited. Exposed surfaces shall be protected from drying for at least 7 (seven) days. All forms shall be built true and rigid. Form removal shall not injure the concrete.

D. All concrete is to be finished with a hard, smooth troweled finish and is to be faced smooth with rounded corners.

1.15 INSPECTION AND TESTING

A. General

1. New fire protection systems shall be tested to disclose leaks and defects.
2. The Contractor shall notify the Professional a minimum of 5 (five) working days prior to testing to coordinate the testing and inspection procedures.
3. If the Professional determines that the fire protection systems do not pass the prescribed tests, then the Contractor shall be required to make the necessary repairs, at his own expense, and the Contractor shall re-inspect and re-test the systems. Repairing, inspection and testing shall be continued until all systems pass as determined by the Professional.
4. All new, altered, extended or replaced fire protection shall be left uncovered and unconcealed until it has been inspected, tested and accepted by the Professional. Where such work has been covered or concealed before it has been inspected, tested and accepted, it shall be uncovered by the Contractor, at his own expense as directed by the Professional.
5. All equipment, material, labor, etc., required for testing the fire protection systems shall be furnished by the Contractor.

1.16 INSTRUCTION OF THE OWNER

A. After acceptance of the Project, the Contractor shall furnish the services of personnel thoroughly familiar with the completed installation to instruct the Owner in the proper operation and maintenance of all equipment and appurtenances provided.

B. The Contractor shall provide the Owner with two weeks' notice before the instruction session.

1.17 CHASES AND OPENINGS

A. All chases and openings required for the installation of the work shall be coordinated with the other trades. The Contractor shall provide the other trades with sufficient time (1 (one) week minimum) for coordination of all chases and openings. The contractor shall be responsible for all work required to cut and patch the required openings. The work shall be performed to the satisfaction of the Professional.

B. Penetrations made in fire rated chases, partitions, floors, etc., shall be sealed with an approved material and method as required to maintain the integrity of the fire separation.

C. The Contractor shall provide all sleeves, hangers, and anchors required for installation of work in chases and openings.

1.18 PAINTING

A. Painting shall be in accordance with Division 09.

1.19 RELATED WORK

A. All work related to providing complete fire protection systems and equipment shall be the responsibility of the Contractor. The following related work shall be provided as indicated in other specification Divisions, unless noted otherwise, but shall remain the responsibility of the Contractor for workmanship and completeness:

1. General Contractor

   a. Installation of access panels.
   b. Concrete housekeeping pads for fire protection equipment.
   c. Removal of existing concrete housekeeping pads.

2. Food Service Equipment Contractor

   a. Kitchen hood fire extinguishing systems.

3. Electrical Contractor

   a. Verification of the proper rotation of three phase equipment, and making modifications as required to correct improper rotation.
   b. Installation of all combination starters/disconnects and overload protectors.

1.20 MISCELLANEOUS STEEL AND ACCESSORIES

A. The contractor shall provide all necessary steel angles, channels, pipe, rods, nuts, bolts, etc., as shown on plans, as specified, or as may be required for complete and proper installation of sprinkler piping, systems and equipment. All material and workmanship shall be of the best quality and shall be installed in accordance with the best practices of the trade.

1.21 ACCESS PANELS

A. The Contractor shall furnish access doors to the General Contractor for installation in ceilings, walls, partitions and floors for access to valve and other appurtenances.

B. Access panels shall be of sufficient size to permit removal or access to equipment, except that the minimum size shall be 12-inches by 16-inches.

C. Access door locations shall be as determined by field conditions for optimum access to equipment, and shall be reviewed by the Professional before final installation

D. Access doors shall be suitable for installation in the finish material of the ceilings, walls, partitions and floors.

E. Frame and panel access doors in restrooms, kitchens and as indicated shall be stainless steel.

F. Access doors with UL Listing shall be provided in rated construction assemblies. Access doors shall be “B-Label” and shall have a UL one and one-half (1-1/2) hour rating at 250 degrees F rating for both door and frame. Maximum size shall be 20” x 20” or 400 square inches in area. Frame shall be sixteen (16) gauge minimum steel, panel shall be twenty (20) gauge minimum steel. Access doors shall be provided with a baked-on enamel finish (prime coat), continuous type hinge on one side, flush-face type lock with key operation and self-latching cylinder locks.

G. Access doors without UL label shall be provided in all non-rated construction assemblies: Frame shall be sixteen (16) gauge minimum steel, panel shall be fourteen (14) gauge minimum steel. Access doors shall be provided with a baked-on enamel finish (prime coat), concealed spring type hinges and flush-face type lock with key operation and self-latching cylinder locks. Door shall open 175 degrees (minimum).

H. All access doors shall be keyed alike.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials used on fire protection systems shall meet the requirements of applicable codes, standards, and requirements of Local Authorities Having Jurisdiction and the Owner's Insurance Carrier.

2.2 SPRINKLER PIPING, ABOVE GROUND

A. Piping: black steel meeting ASTM A53, ASTM A135, or ASTM A795.

1. Piping 2-½" and larger shall be Schedule 10 with roll-grooved, flanged or welded connections.
2. Piping 2" and smaller shall be Schedule 40 with threaded or welded connections.
3. Piping shall be hot-dipped galvanized where specified herein or noted on the drawings.

B. Fittings: UL-listed, standard weight suitable for pressures up to 250 psig, cast iron meeting ASTM A126 or malleable iron meeting ASTM A197. Threaded cast iron fittings shall meet ANSI B16.4; flanged cast iron fittings shall meet ANSI B16.1. Threaded malleable iron fittings shall meet ANSI B16.3. Grooved fittings and couplings shall be UL-listed and shall be of ductile iron meeting ASTM A536, utilizing an EDPM gasket. Fittings shall be short pattern, with flow equal to standard pattern fittings. Plain-end fittings and couplings,or welded-segmented fittings shall not be used. Changes in pipe diameter shall be made using tapered reducing fittings. Bushings or grooved-end reducing couplings shall not be used unless standard reducing fittings are not regularly available.

1. Grooved joint couplings shall be:
   a. Rigid Type: Housings shall be cast with offsetting angle-pattern bolt pads to provide rigidity and system support and hanging in accordance with NFPA-13. Couplings shall be fully installed at visual pad-to-pad offset contact. (Tongue and recess type couplings, or any coupling that requires exact gapping of bolt pads on each side of the coupling at specified torque ratings, are not allowed.)
      1) 1-½" through 4": Installation-Ready, for direct stab installation without field disassembly.
   b. Flexible Type: For use in locations where vibration attenuation and stress relief are required, and for seismic applications.
2. Gaskets:

Fire Protection Service	Temp. Range	Gasket Recommendation
Dry Systems	Ambient	FlushSeal®, Grade EPDM, Type A

Freezer Applications	-40°F to 0°F	FlushSeal®, Grade L, Silicone
Water/Wet Systems	Ambient	Grade EPDM, Type A

2.3 VALVES FOR FIRE PROTECTION SYSTEMS

A. Gates Valves: Class 125, comply with MSS SP-80, bronze body, screwed bonnet, rising stem, solid wedge. 3" and larger; comply with MSS SP-70, iron body, bronze trim, rising stem, hand wheel, OS&Y, flanged or grooved ends.

B. Butterfly Valves:

1. Comply with MSS SP-67, lug type, cast or ductile iron body, chrome plated ductile iron disk, EPDM seat, extended neck, handwheel and gear drive and integral indicating device, built-in tamper proof switch, 200 PSI rating.
2. Grooved end type with ductile iron body, EPDM coated ductile iron disk with integrally cast stem, handwheel and gear drive and integral indicating devices, with weatherproof actuator and supervisory switches, 300 PSI rating.

C. Spring-Actuated Check Valves: 250 PSI rating, grooved end ductile iron one-piece body, stainless steel spring and shaft, suitable for vertical or horizontal installations.

D. Check Valves: Class 125, comply with MSS SP-80 bronze body, screwed cap. "Y" pattern swing, bronze disc. 3" and larger, comply with MSS SP-71, class 125, iron body, bronze mounted, horizontal swing, cast iron disc.

2.4 DRAIN VALVES

A. Provide bronze compression stop with hose thread nipple and cap.

PART 3 - EXECUTION

3.1 GENERAL

A. All materials and equipment used shall be installed in strict accordance with the Standards under which the materials are accepted and approved, and in strict accordance with the manufacturer’s instructions.

B. The Contractor’s Drawings shall indicate every bend, offset, change in direction and appurtenance required to provide a complete and workable system.

C. Grooved joints shall be installed in accordance with the manufacturer’s latest published installation instructions. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Gaskets shall be of an elastomer grade suitable for the intended service and shall be molded and produced by the coupling manufacturer. The grooved coupling manufacturer’s factory trained representative shall provide on-site training for contractor’s field personnel in the use of grooving tools and installation of

grooved joint products. The representative shall periodically visit the jobsite and review contractor is following best recommended practices in grooved product installation. (A distributor's representative is not considered qualified to conduct the training or jobsite visit(s).)

3.2 INSTALLATION OF EQUIPMENT

A. Aboveground Pipe

1. Run pipe parallel to column centerlines. Install pipe as high as possible in unfinished areas to maintain maximum headroom. Piping shall bear evenly on hangers and supports.

2. Provide means to drain entire piping system. Pitch dry pipe system branch lines and mains to drain in accordance with NFPA 13.

3. Use Schedule 40 black steel piping and fittings for compressed air piping, ball drip discharges, and test or drain piping subject to alternate wetting and drying. Where dry sprinkler piping is installed outside or exposed to exterior corrosion, provide powder coated pipe for corrosion protection.

4. Threads on fittings and bolts shall be fully engaged. Pipe threads shall be made up using joint compound or Teflon tape.

5. Pipe drains and discharges from relief valves and automatic ball drip valves to spill directly over the nearest floor drain or outside the building. Pipe main drain and test connections to discharge at a safe point outside the building unless indicated otherwise on the Drawings.

6. Torch cutting and field welding are not permitted in sprinkler systems.

7. System layout shall follow the layout and minimum sizes indicated on the Drawings. Provide additional fittings and offsets as required to coordinate with other trades.

8. Piping shall not be supported from ductwork or other equipment.

B. Control Valves and Accessories

1. Install gate valves with stems pointing at or above the pipe centerline.

C. Alarm and Supervisory Devices

1. Tamper switches shall not interfere with valve operation and shall be adjusted to initiate a signal before the valve stem moves more than 20% of its total travel or two handwheel revolutions from its normal position. Valves shall be monitored in the normally open positions unless indicated as normally closed on the Drawings.

2. Adjust retard mechanisms of vane-type water flow switches for a 20-second delay.

3. Provide an inspector's test connection with site glass, orifice, and shutoff valve for each water flow switch in each system.

D. Accessories

1. Install sprinkler cabinet near the sprinkler water entrance or as directed by the Owner.

2. Install valve identification signs as required by NFPA 13. Install hydraulic nameplates on system risers. Record all hydraulic data on each nameplate as required by NFPA 13.

3.3 SEISMIC RESTRAINTS

A. The Sprinkler Contractor shall coordinate with the General Contractor to determine site classification and seismic requirements for this project. Where required, the Sprinkler Contractor shall be responsible for providing restraints to resist the earthquake effects on the Sprinkler system(s). The requirements for these restraints are found in the 2009 North Carolina Building Code.

B. The Sprinkler Contractor shall refer to the latest edition of the "Seismic Restraint Manual Guidelines for Mechanical Systems" published by SMACNA for guidelines to determine the correct restraints for piping.

C. The Sprinkler Contractor shall include shop drawings of the specific methods of seismic restraint to be used for this project before installation of piping, ductwork, and equipment.

D. Any required anchorage of the equipment and materials for this project shall be an integral part of the design and specification of such equipment and materials. Manufacturers of all equipment shall provide anchorage details, isolators, seismic mounts and restraints, etc. necessary to comply with Code requirements.

E. The Sprinkler Contractor shall retain the services of a Professional Structural Engineer licensed in the State of North Carolina to design seismic restraint elements required for this project. The engineer's computations, bearing his professional seal, shall accompany shop drawings which show Code compliance. Computations and shop drawings shall be submitted for review prior to the purchasing of materials, equipment, systems and assemblies.

F. Internal seismic restraint elements of manufactured equipment shall be certified by a Professional Engineer retained by the manufacturer. Such certificate applies only to internal elements of the equipment. All equipment anchorage requirements shall be coordinated with the building structure and shall be compatible thereto. All such anchorage shall be reviewed by the project's structural engineer.

G. The professional engineer retained by the Sprinkler Contractor for seismic restraint calculations shall visit the job site upon completion of the seismic restraint installation. This Engineer shall provide in writing verification of compliance with the approved seismic submittal. This verification shall bear the Engineer's professional seal. Job site inspection by other than this Engineer is not acceptable. This engineer shall also be responsible for any required special inspections and associated documentation.

H. Review of the seismic design and shop drawings by the Engineer/Architect or his agent shall not relieve the Sprinkler Contractor of his responsibility to comply with the seismic or any other requirements of the International Building Code.

END OF SECTION

SECTION 21 13 13

WET-PIPE SPRINKLER SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes wet-pipe sprinkler system guidelines for system design, installation, and certification.

B. Related Sections:
   1. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for electric connections to equipment specified by this section.

1.2 REFERENCES

A. National Fire Protection Association:
   1. NFPA 13 - Installation of Sprinkler Systems.

1.3 SYSTEM DESCRIPTION

A. System to provide coverage for entire building.

B. Provide a hydraulically designed system to NFPA 13 occupancy requirements.

C. Obtain up-to-date flow test data. Determine volume and pressure of incoming water supply from water flow test data. Provide flow test data on the Shop Drawings.

D. Interface sprinkler system with building fire and smoke alarm system.

E. For new systems, provide fire department connections as indicated on Drawings.

1.4 PERFORMANCE REQUIREMENTS

A. Standard-Pressure Piping System Component: Listed for 175-psig (1200-kPa) minimum working pressure.

B. Delegated Design: Design sprinkler system(s), including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated
   1. Provide fire-hydrant flow test records to indicate the following conditions:
      a. Time of test
      b. Name and Company of person performing the test
      c. Location of Residual Fire Hydrant
      d. Location of Flow Fire Hydrant
      e. Static Pressure at Residual Fire Hydrant
      f. Measured Flow at Flow Fire Hydrant
      g. Residual Pressure at Residual Fire Hydrant

C. Sprinkler system design shall be approved by authorities having jurisdiction.

1. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
2. See Fire Protection drawings for recommended Sprinkler Occupancy Hazard Classifications:
3. See Fire Protection drawings for recommended Minimum Density for Automatic-Sprinkler Piping Design:
4. Maximum Protection Area per Sprinkler: Per UL listing.
5. Total Combined Hose-Stream Demand Requirement: Per NFPA 13 unless otherwise indicated:
    a. Light-Hazard Occupancies: 100 gpm for 30 minutes.
    b. Ordinary-Hazard Occupancies: 250 gpm for 60 to 90 minutes.
6. Seismic Performance: Refer to section 21 05 00

1.5 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Provide layout of finished ceiling areas indicating sprinkler locations coordinated with ceiling installation and the work of other trades (ductwork, lights and any other ceiling mounted devices). Show detailed pipe layout, hangers and supports, sprinklers, components and accessories. Indicate system controls.

C. Product Data: Submit data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

D. Design Data: Submit design calculations signed and sealed by a professional engineer.

E. Sprinklers shall be referred to on drawings, submittals, and other documentation, by the sprinkler identification or model number as specifically published in the appropriate agency listing or approval. Trade names or other abbreviated designations shall not be allowed.

1.6 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and inspector’s test locations.

C. Operation and Maintenance Data: Submit components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.

1.7 QUALITY ASSURANCE

A. Perform Work in accordance with NFPA 13.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

C. Design system under direct supervision of Professional Engineer experienced in design of this Work and licensed at Project location (state).

1.9 DELIVERY, STORAGE, AND HANDLING

A. Division 01 - Product Requirements: Product storage and handling requirements.

B. Store products in shipping containers until installation.

C. Furnish piping with temporary inlet and outlet caps until installation.

1.10 WARRANTY

A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish five (5) year manufacturer warranty for system components.

1.11 EXTRA MATERIALS

A. Division 01 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish extra sprinklers under provisions of NFPA 13.

C. Furnish suitable wrenches for each sprinkler type.

D. Furnish metal storage cabinet in location designated by Architect, adjacent to system riser.

PART 2 PRODUCTS

2.1 SPRINKLERS

A. Suspended Ceiling Type:
   1. Type: Concealed pendant type with coverplate.
   2. Color of coverplate: Coordinate with Architect.
   3. Fusible Link: temperature rated for specific area hazard.

B. Exposed Area Type:
   1. Type: Standard upright type.
   2. Finish: Brass.
   3. Fusible Link: temperature rated for specific area hazard.

C. Side wall Type:

1. Type: Recessed horizontal side wall type with matching escutcheon plate.
2. Finish: Chrome plated.
3. Escutcheon Plate Finish: Chrome plated.
4. Fusible Link: temperature rated for specific area hazard.

D. Guards: Finish to match sprinkler finish.

2.2 PIPING SPECIALTIES

A. Wet Pipe Sprinkler Riser Check Valve: Ductile iron body, swing check type valve with brass seat and rubber-faced or aluminum-bronze clapper with elastomer seal. Provide complete with main drain valve and pressure gauges. Rated for 250 psi working pressure. Valve internal components shall be replaceable without removing from the installed position.

B. Electric Alarm: Electrically operated gong with pressure alarm switch.

C. Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two contacts; rated 10 amp at 125 volt AC and 2.0 amp at 24 volt DC.

D. Fire Department Connections:
1. Flush mounted wall type with chrome plated finish.
2. Outlets: Two-way with fire department thread size. Threaded dust-cap and chain of matching material and finish.
3. Drain: 3/4-inch automatic drip, outside or connected to drain.
4. Label: "Sprinkler - Fire Department Connection"

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with NFPA 13.

B. Locate fire department connection with sufficient clearance from walls, obstructions, or adjacent fire department connectors to allow full swing of fire department wrench handle.

C. Locate outside alarm-gong on building wall as indicated on Drawings.

D. Place pipe runs to minimize obstruction to other work.

E. Install piping in concealed spaces above finished ceilings.

F. Center sprinklers in two directions in ceiling tile and install piping offsets.

1. A stainless steel flexible drop system may be used to properly locate sprinkler heads. The drop system shall be braided type and supplied with required supporting members and bracing. Unbraided piping system will not be accepted.

G. Do not install sprinklers that have been dropped, damaged, or show a visible loss of fluid. Never install sprinklers with cracked bulbs.

H. Sprinkler bulb protector shall be removed by hand after installation. Do not use tools or any other device(s) to remove the protector that could damage the bulb in any way.

I. Connect to fire pump system in accordance with Section 21 30 00 and NFPA 13.

J. Install guards on sprinklers where required to protect sprinklers from physical damage.

K. Hydrostatically test entire system.

L. Require test be witnessed by authority having jurisdiction.

3.2 INTERFACE WITH OTHER PRODUCTS

A. Verify signal devices are installed and connected to fire alarm system.

3.3 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Flush entire piping system of foreign matter.

3.4 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting installed construction.

B. Apply masking tape or paper cover to protect concealed sprinklers, cover plates, and sprinkler escutcheons not receiving field paint finish. Remove after painting. Replace painted sprinklers with new.

END OF SECTION

Construction Documents 6/12/24

SECTION 21 30 00

FIRE PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes Deisel Driven Skid Mounted Fire Pump System:

1. Fire Pump
2. Fire Pump Controller
3. Pressure-maintenance (Jockey) Pump
4. Jockey Pump Controller
5. Fire Pump Skid
6. Exterior Enclosure

1.3 PERFORMANCE REQUIREMENTS

A. Pump, Equipment, Accessory, Specialty, and Piping Pressure Rating: 175-psig minimum working-pressure rating, unless otherwise indicated.

B. The Contractor shall provide and install a packaged fire pump system in exterior enclosure, designed in accordance with the requirements of NFPA 20, built and listed to UL448 for fire pump units and UL 728 for pump packages. The fire pump shall be listed and / or approved by Factory Mutual for fire pump service at the specified rating. The packager will assume unit responsibility for the proper operation of the entire packaged system as specified herein.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, certified pump performance curves with each selection point indicated, operating characteristics, and furnished accessories and specialties for each fire pump and pressure-maintenance pump.

B. Shop Drawings: For fire pumps and drivers, fire-pump controllers, fire-pump accessories and specialties, pressure-maintenance pumps, pressure-maintenance-pump controllers, and pressure-maintenance-pump accessories and specialties. Include plans, elevations, sections, details, and attachments to other work.

1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

2. Wiring Diagrams: Power, signal, and control wiring.

C. Manufacturer Seismic Qualification Certification: Submit certification that fire pumps and drivers and fire-pump controllers, pressure-maintenance pumps, accessories, and specialties will withstand seismic forces defined in Division 21 Section "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Product Certificates: For each type of fire pump and fire-pump controller, signed by product manufacturer.

E. Source quality-control test reports.

F. Field quality-control test reports.

G. Operation and Maintenance Data: For fire pumps and drivers, pressure-maintenance pumps, controllers, accessories and specialties, alarm panels, and flowmeter systems to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain fire pumps, pressure-maintenance pumps, and controllers through one source from a single manufacturer for each type of equipment.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of fire pumps, pressure-maintenance pumps, and controllers and are based on specific systems indicated. Refer to Division 01 Section "Product Requirements."

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with standards of authorities having jurisdiction pertaining to materials, hose threads, and installation.

E. Comply with NFPA 20, "Stationary Pumps for Fire Protection," for fire pumps, drivers, controllers, accessories, and their installation.

1.6 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 HORIZONTAL FIRE PUMPS

A. Description, General: UL 448, factory-assembled and -tested, horizontally mounted, radially split case, bronze fitted, horizontal fire pump with diesel motor driver direct-mounted to pump casing, of capacities and characteristics. The fire pump and motor shall be factory mounted on a common base plate.

   1. Manufacturers:
      a. A-C Pump; Xylem Brand
      b. Armstrong Darling, Inc.
      c. Aurora Pump; Pentair Pump Group
      d. Fairbanks Morse; Pentair Pump Group
      e. Patterson Pump Company

B. Characteristics: Capable of furnishing not less than 150 percent of rated capacity at not less than 65 percent of total rated head. Shut-off head is limited to 140 percent of total rated head.

C. Casing Construction: Radially split case, centrifugal design: cast iron pump casing with suction and discharge flanges machined to ASME B16.1 dimensions, and 125 psig pressure rating, except where 250 psig rated flanges are indicated.

D. Impeller Construction: Statically and dynamically balanced, closed, single suction, cast bronze, and keyed to shaft.

E. Pump Shaft and Sleeve: Ground and polished steel shaft with bronze sleeves.

F. Seals: Stuffing box having a minimum of 5 rings of graphite impregnated braided yarn with a lantern ring between center graphite rings and a bronze packing gland.

G. Finish: Manufacturer’s standard red paint applied to factory assembled and -tested unit before shipping.

H. Nameplate: Complete with capacities, characteristics, and other pertinent data.

2.3 FIRE PUMP DRIVERS

A. Description, General: UL 1247, horizontal-shaft, open-type diesel engine.

1. Manufacturers:
   a. Clarke Fire Protection Products, Inc.
   b. Cummins Inc.
   c. Caterpillar
   d. Armstrong Darling, Inc.

B. Finish: Manufacturer's standard red paint applied to factory-assembled and -tested unit and ferrous metal accessories before shipping.

C. Nameplates: Provide nameplates, complete with driver horsepower, characteristics, and other pertinent data.

D. Emergency Manual Operator: Factory wired for standby engine starting and operation in case of main controller or wiring malfunction.

E. Engine Cooling System: Factory – installed water piping, valves, strainer, pressure regulator, heat exchanger, coolant pump, bypass piping, and fittings. Include ASTM B 88, type L, copper water tube; ASME B16.22, wrought-copper, solder-joint pressure fittings: AWS A5.8, BcuP Series Brazing filler metal; and brazed joints.

F. Exhaust Connector: Flexible type.

G. Exhaust Silencer: Residential type.

H. Engine – Jacket Water Heater: Factory-installed electric elements.

I. Dual Batteries: Lead acid storage type, with 100 percent standby reserve capacity.

J. Fuel System: According to NFPA 20.

K. Fuel Storage Tank: Size indicated, but not less than required by NFPA 20. Double wall fuel tank. Included floor legs, and direct-reading level gage.

L. Exhaust System: ASTM A 53, Type E or S, Schedule 40, black steel pipe; ASME B16.9, weld type pipe fittings; ASME B16.5, steel flanges; and ASME B16.21, nonmetallic gaskets fabricate double wall, ventilate thimble from steel pipe.

2.4 CONTROLLERS

A. Description: Combined automatic and non-automatic operation, complying with UL 508, UL listed, and FM approved, factory assembled and wired, and factory tested for capacities and characteristics, and with features indicated.

B. Enclosure: NEMA ICS 6, Type 2, drip proof, indoor, except where special purpose enclosure is indicated.

C. Provide controls, devices alarms, functions, and operations listed in NFPA 20, as required for the driver and controller, and the specific items listed for each controller type.

D. Nameplates: provide nameplate complete with capacity, characteristics, approvals and listings, and other pertinent data on enclosure door.

E. Enclosure Mounting: Wall mounting, for field electrical connections.

F. Finish: Manufacturer's standard red paint applied to factory-assembled and -tested units before shipping.

G. Controller Sensing Pipes: Fabricate pipe and fittings according to NFPA 20 with nonferrous-metal sensing piping, ½-inch size, with globe valves for testing controller mechanism from system to pump controller, as indicated. Include a bronze check valve with a 3/32-inch orifice in the clapper or a ground-face union with a non-corrosive diaphragm having a 3/32 inch orifice.

2.5 FIRE-PUMP CONTROLLERS

A. Description: UL 218 and NFPA 20; listed for diesel-drive, fire-pump service and service entrance; combined automatic and manual operation; factory assembled and wired; and factory tested for capacities and electrical characteristics.

1. Manufacturers:

   a. Cutler-Hammer.
   b. Firetrol, Inc.
   c. Hubbell Industrial Controls, Inc.
   d. Joslyn Clark.
   e. Master Control Systems, Inc.
   f. Metron, Inc.

2. Enclosure: UL 50, Type 2, drip proof, indoor, unless special-purpose enclosure is indicated.
3. Enclosure Finish: Manufacturer's standard red paint applied to factory-assembled and tested unit before shipping.
4. Mounting: Floor stand type for field electrical connections.
5. Built-in dual battery charger.
6. Time clock for weekly automatic test.
7. System pressure recorder.
8. Sequence Start Cycle
9. Alarm contacts for remote alarm of "Engine Run", "Switch Off", and "Engine Failure"

2.6 PRESSURE-MAINTENANCE PUMPS

A. Pressure-Maintenance Pumps: Centrifugal, vertical construction, base mounted, factory assembled and -tested for capacities and characteristics indicated.

1. Manufacturers:

a. Goulds Pumps, Xylem Brand
b. Paco Pumps, Inc.
c. Taco, Inc.

B. Construction: Cast-iron pump casing with suction and discharge connections of size indicated, threaded, or flanged and machined to ASME B16.1 dimensions, and 125 psig minimum pressure rating, except where 250 psig rated flanges are indicated.

C. Impeller: Bronze or stainless steel.

D. Seals: Mechanical

E. Finish: Manufacturer's standard paint applied to factory-assembled and -tested unit before shipping.

F. Pressure Maintenance Pump Controllers: Across-the-line type, UL 508, UL listed, factory-assembled, -wired and -tested, combined automatic and manual operation. Include types, capacities, characteristics, and features indicated for electric drive, pressure maintenance pump service.

1. Manufacturers:

a. Cutler-Hammer.
b. Firetrol, Inc.
c. Hubbell Industrial Controls, Inc.
d. Joslyn Clark.
e. Master Control Systems, Inc.
f. Metron, Inc.

2. Enclosure: NEMA ICS 6, Type 2, wall-mounted, for field electrical wiring.

3. Include controls, devices, alarms, functions, and questions listed in NFPA 20, and specific items listed.

4. Rate controller for scheduled horsepower and include the following:

a. Fusible disconnect switch.
b. Pressure switch with independently adjustable high and low set points.
c. “Hand-Off-Auto” selector switch.

5. Nameplates: Complete with capacity, characteristics, approvals and listings, and other pertinent data on enclosure door.

6. Mounting: Wall type for field electrical connections.

7. Finish: Manufacturer’s standard paint applied to factory-assembled and -tested units before shipping.

8. Controller Sensing Pipes: Fabricate pipe and fittings according to NFPA 20 with nonferrous-metal sensing piping, ½-inch size, with globe valves for testing controller mechanism from system to pump controller, as indicated. Include a bronze check valve

with a 3/32-inch orifice in the clapper or a ground-face union with a non-corrosive diaphragm having a 3/32 inch orifice

2.7 SKID PACKAGE

A. All wiring shall be installed with EMT and/or liquid tight conduit.

B. Fire pump fittings shall include the following:
1. An automatic air release valve
2. Compound suction and discharge gauges (3.5 inch dials) supplied and sized per NFPA 20
3. A listed OS&Y isolating gate suction valve
4. A listed butterfly discharge valve with tamper switch
5. A listed wafer check valve
6. Test Header and valves
7. City Bypass loop

C. All the equipment listed above will be mounted on an open structural steel base plate. All piping will be firmly anchored to the steel base by means of flange, saddle, or clamp supports as required. All electrical connections and wiring will be completed and inspected at the packager's facility prior to shipment to the job site. Wall thickness and flange sizes will be based on the maximum working pressure.

D. The fire pump will be factory performance tested in accordance with the requirements of NFPA, UL and FM. The fire pump and jockey pump controllers will be electrically tested prior to shipment. Additionally, the entire package system will be hydrostatically tested at the factory at a pressure rating per NFPA 20 Section 11-1.1 for a minimum of 2 hours. A copy of the test procedures shall be provided upon request.

E. All welded pressure bearing piping must be fabricated with full penetration welds. Qualification of the welding procedures and performance of the welders shall comply with the requirements of ANSI/ASME B31.1 and ASME code, Section IX. All structural welding shall be certified per AWSD 1.1 or ASME Section IX.

F. All frame welds shall be performed by ASME qualified welders per Section IX of the ASME Code.

G. All components painted by the fire pump packager shall be "fire pump red".

H. The pump/package representative, to be one and the same, shall conduct the field acceptance testing of the entire package.

2.8 HOUSE PACKAGE

A. General:

1. Each enclosure shall be supplied complete with all necessary component parts to form a complete enclosure system. All parts shall be new and free from any defects or imperfections.

2. The enclosure supplier shall supply a complete set of enclosure erection drawings showing a step-by-step construction sequence for the erection of the enclosure. The erection drawings shall be prepared specifically for the enclosure covered by these specifications showing the location of all roof and wall accessories and the exact anchor bolt locations required for each accessory.

B. Design Criteria:

1. All enclosures shall be designed in accordance with the applicable sections of the latest edition of the AISC "Specifications for Structural Steel Buildings" and the AISI "Specification for the Design of Cold-Formed Steel Structural Members".

2. Each enclosure shall be designed for the following loads, in addition to the stationary weight of the enclosure. Reduction of loads due to tributary loaded areas will not be permitted.

   a. The vertical live load of the enclosure shall not be less than 40 pounds per square foot applied on the horizontal projection of the roof.
   b. The horizontal wind load of the enclosure shall not be less than 110 MPH and shall be distributed and applied in accordance with the applicable edition of the Metal Building Manufacturers Association (MBMA) publication titled "Low Rise Building Systems Manual".
   c. The enclosure shall be designed to resist the effects of seismic ground motions which may be expected in seismic zone 4.

3. All combining and distributing of auxiliary equipment loads imposed on the enclosure system shall be done in accordance with the applicable section of the MBMA publication titled "Low Rise Building Systems Manual".

4. Upon request, the selected enclosure manufacturer shall provide the enclosure purchaser with a complete design certification signed and sealed by a registered professional engineer.

C. Roof Panel Design:

1. Roof panels shall be supplied in a single continuous length from eave line to ridge line and shall be designed to tightly interlock so that no fasteners are required at intermediate points along the panel side laps.

2. Roof panels shall be 16" or 12" wide with a smooth surface between the interlocking side ribs. The interlocking ribs shall be a minimum 3" high and shall be turned upward. All roof panels shall be factory-punched for connection at the eave line of the enclosure.

3. There shall be no fastener penetrations through the roof covering except at eave lines, ridge lines, and roof accessory openings such as skylights and ventilators.

4. Roof panels shall be nominal 24-gauge galvanized steel conforming to ASTM A-653 specifications with the galvanized coating conforming to G90 (1.25 oz. commercial) standards. Minimum yield strength of the panel material shall be 50,000 PSI.

5. Roof panels shall receive a factory, roller-applied, paint coating having an exterior coating thickness of 0.8 to 1.2 mils of dry film thickness.

6. The roof panel color coating shall carry a low fire hazard rating equal to a Class 1 material as defined by Factory Mutual. The Panel coating shall have achieved a Flame Spread Index of 0 and a Fuel Contributed Index of 5 or less when tested in accordance with ASTM E-84 test procedures.

7. The finish coat shall be a white siliconized polyester formulation that will meet the following performance standards after 10 years continuous exposure in "normal" atmospheric conditions not containing corrosive fumes such as chemicals or salt spray.

   a. Panels shall show no evidence of blistering, peeling, or chipping.
   b. Panels shall not show surface chalking in excess of the No. 4 rating D659 as established by the American Society of Testing Materials (ASTM).
   c. Panels, after cleaning, shall not show color change in excess of 7 NBS units when measured in accordance with ASTMD-2244 standard.
   d. The above performance standards shall not apply where panels have been damaged by fire, radiation, or other physical damage.

8. Roof panels shall be coated on both sides with a coating of corrosion resistant aluminum-zinc alloy conforming to ASTM A 792 specification, with the coating conforming to AZ55 (55%) standard by a continuous hot dipping process. Coating weight shall be a minimum of 0.32 oz. of aluminum-zinc alloy per square foot of coated sheet equivalent to about 0.75 mil thickness on each side. Minimum yield strength of panel material shall be 50,000 PSI.

D. Wall Panel Design:

1. Exterior wall panels of the enclosure shall be a single continuous length from the base channel to the roof line of the enclosure and at the side walls and end walls of the enclosure except where interrupted by wall openings.

2. Wall panels shall be 16" wide with a 3" deep inward turned interlocking side rib. Wall panels shall contain two 3/4" deep by 3-1/8" wide fluted recesses, each starting 2-7/16" from the panel edge.

3. Wall panels shall be fastened internally to the base channel and eave cap of the enclosure with 3/8" diameter electro-galvanized machine bolts placed within the panel interlock. The fastening system shall be designed so that no wall fasteners are exposed on the exterior surface of the walls.

4. Wall panels shall be nominal 24-gauge galvanized steel conforming to ASTM A-653 specifications with the galvanized coating conforming to G90 (1.25 oz. commercial) standards.

5. Minimum yield strength of panel material shall be 40,000 PSI. Panel material shall be embossed with a random pattern pebble embossed of approximately .007 - .008 depth.

6. All exterior surfaces of the galvanized steel wall covering, and exterior trim shall receive a factory, roller applied, paint coating having an exterior coating thickness of 0.8 to 1.2

mils of dry film thickness. The finish coat for wall panels shall be a siliconized polyester formulation.

7. The wall panel color coating shall carry a low fire hazard rating equal to a Class 1 material as defined by Factory Mutual. The panel coating shall have achieved a Flame Spread Index of 0 and a Fuel Contributed Index of 5 or less when tested in accordance with ASTM E-84 test procedures.

8. Exterior color coatings shall meet the following performance standards after 10 years continuous exposure in normal atmospheric conditions not containing corrosive fumes such as chemical fumes or salt spray:

   a. Panels shall show no evidence of blistering, peeling, or chipping.
   b. Panels shall not show surface chalking in excess of the No. 4 rating D659 as established by the American Society of Testing Materials (ASTM).
   c. Panels, after cleaning, shall not show color change in excess of 7 NBS units when measured in accordance with ASTMD-2244 standard.
   d. The above performance standards shall not apply where panels have been damaged by fire, radiation, or other physical damage

E. Enclosure Type:

1. Each enclosure roof shall have 1-1/2" pitch in enclosure width. Roof panels shall be interlocking and attached to the wall cap through factory punched holes with #14 corrosion resistant fasteners.

2. The roof system shall include a gutter and downspout system at the low side wall and matching rake trim at the enclosure end walls. All gutters and trim shall be nominal 26-gauge galvanized steel pre-painted.

3. Transmission of horizontal wind loads across the enclosure shall be made through the panel roof system and no separate roof or wall diagonal bracing shall be required.

4. Structural support and attachment of roof at existing enclosure shall be the responsibility of others. In snow prone areas, drifting should be considered.

5. Where required for proper transmission of lateral wind loads, structural frame wind belts shall be installed. Wind bents shall consist of a prime painted column and rafter bolted assembly of steel conforming to ASTM A-36 specifications.

F. Gutters, Downspouts, and Eaves:

1. The eaves of the enclosure shall have a gutter and downspout system of nominal 26-gauge factory painted gutters of the same configuration as the enclosure rake trim and 2" x 3" box type aluminum downspouts. Gutters and downspouts shall be the same color as the enclosure rake trim and shall be complete with all required outlet drops, elbows and connecting hardware.

2. The eaves of the enclosure shall have a nominal 26-gauge factory painted eave trim of the same configuration and color as the enclosure rake trim. The eave trim shall allow free passage of roof drainage.

G. Hollow Metal Doors:

1. All doors shall be 1-3/4" thick flush-type. Door panels shall be nominal 20-gauge galvanized steel reinforced by lamination to a honeycomb core enclosed with 16 gauge end channel. The hinge reinforcements shall be nominal 7 gauge and the lock reinforcements shall be nominal 16 gauge.

2. Door frames shall be 4-3/4" deep double rabbeted type of nominal 16-gauge galvanized steel.

3. Doors and frames shall be factory painted with one coat of baked on primer. All doors shall be pre-assembled in their frames and hardware installed and tested prior to shipment. Field installation of single leaf door units shall not require any frame assembly or door hanging.

H. Door Hardware:

1. Door hardware shall consist of 3 - 4-1/2" x 4-1/2" standard weight, plain bearing hinges per ANSI A5133 630 Satin Stainless Finish with non- rising pins.

2. 3-11/16” wide x 5/8” high extruded aluminum threshold. (Out Swing)

3. 1/4" x 1/2" silicone rubber weather-stripping.

4. Mortise lockset per ANSI A156.13, Series 100, Grade 1, Function F13, 626 Satin Chrome Finish (levers both sides).

5. Cylindrical key in knob lockset per ANSI A156.2, Series 4000, Grade 2, Function F81 630 Satin Stainless Steel Finish.

6. Passage set per ANSI A156.2, Series 4000, Grade 2, Function F75, 626 Satin Chrome Finish.

7. Door closer is certified to conform to ANSI 156.4 Grade 1 and meets exterior barrier free codes in 689 Aluminum Lacquer Finish.

8. Rim Type "Cross Bar" panic device per ANSI A156.3, Type 1, Grade 1, Function 05, with 627 Satin Aluminum Finish.

9. Rim type "Push Pad" panic device built to ANSI A156.3, Type 1, Grade 2, Function 08 with 689 Aluminum Lacquer Interior Finish and 626 Satin Chrome Exterior Finish.

I. Louver:

1. The louver shall be of the flanged self-framing design. The louver frame shall be of nominal 14 gauge formed aluminum. The louver blades shall be nominal 12 gauge extruded aluminum. The finish shall be a natural mill finish and shall not require field painting.

2. The blades shall be pivoted to ½” diameter aluminum pivot pins through nylon flanged bearings and operated by means of a pull bar operating handle connected to a solenoid. All louvers shall be complete with an 18-14 aluminum mesh insect screen.

3. The solenoid operator is designed for use with a single panel wall louver. The unit opens the wall louver when the fan motor is activated. The spring returns the louver when deactivated. The solenoid operator is equipped with a mounting plate, linkage and mounting hardware.

J. Fans & Louvers:

1. The exhaust fan shall consist of a shutter, fan assembly, wall sleeve and rear guard. The fan shall have a 115V, 1/6 hp direct drive totally enclosed motor for continuous duty with a thermal overload protection built in. The rear guard shall conform to OSHA specifications.

2. One louvered intake with motorized damper, 24V DC, filter rack and filter, insect screen and weather hood, to be supplied when a diesel engine is enclosed.

K. Formed Wall Liner:

1. The interior of the metal walls shall be lined with 32” wide, nominal 26-gauge galvanized steel panels, pre-painted Arctic White with ¼” high by 1” wide flutes on 8” centers. The exterior panel void shall have 3” thick unfaced fiberglass insulation.

2. The liner system shall be furnished complete with White base molding and White trim.

3. The “U” value of the finished wall system shall be 0.16 BTUs per square foot when calculated in accordance with the “Zone Method” contained in the latest edition of ASHRAE “Handbook of Fundamentals”.

L. Wall Insulation:

1. The enclosure walls shall be insulated with 3" thick, fiberglass faced on its exposed side with a white metalized polypropylene scrim kraft facing. The faced insulation shall have a UL Flame Spread Rating of 25 when tested in accordance with UL723 of ASTM E-84 procedures. The insulation shall be retained between the interlocking panel ribs with a white PVC hat clip over the panel ribs. Hat clips shall be of self-extinguishing material per UL Standard 651.

2. The "U" value through the insulated wall shall be a maximum of 0.19 BTUs per square foot when calculated in accordance with the "Zone Method" contained in the latest edition of ASHRAE "Handbook of Fundamentals”.

M. Ceilings:

1. The metal ceiling system shall consist of 3" deep 16" wide interlocking panels of nominal 24 gauge embossed galvanized steel, factory painted Arctic White. The ceiling system shall be supported at its perimeter by concealed angles and hook bolts. The ceiling system shall be furnished complete with all necessary connectors and fasteners.

N. Roof Insulation:

1. Roof insulation shall consist of 48" wide, 3" thick, .6# density fiberglass faced on its exposed side with a white metalized polypropylene scrim kraft facing. The faced

insulation material shall have a UL Flame Spread Rating of 25 when tested in accordance with UL 723 or ASTM E-84 procedures.

2. Insulation shall be supported at the roof line by means of mechanical clips spaced on maximum 4' centers and shall be sealed by means of a 2" side tabs on the facing.

3. The "U" value through the insulated roof shall be a maximum of 0.10 BTUs per square foot when calculated in accordance with the "Zone Method" contained in the latest edition of ASHRAE "Handbook of Fundamentals".

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, concrete bases, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of fire pumps.

B. Examine roughing-in for fire-suppression piping to verify actual locations of piping connections before fire-pump installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install equipment in accordance with manufacturer's instructions and per NFPA 20.

B. The contractor shall align the pump and motor shafts to within the manufacturer's recommended tolerances prior to system start-up.

C. Power wiring, as required, shall be the responsibility of the electrical contractor. All wiring shall be performed per the manufacturer's instructions and applicable state, federal, and local codes.

D. Control wiring for remote mounted switches and sensor/transmitters shall be the responsibility of the electrical contractor. All wiring shall be performed per the manufacturer's instructions and applicable state, federal, and local codes.

E. Install pressure gages on fire-pump suction and discharge at pressure-gage tappings.

F. Support pumps and piping separately so weight of piping does not rest on pumps.

G. Install piping accessories, hangers and supports, anchors, valves, meters and gages, and equipment supports.

H. Install flowmeters and sensors where indicated. Install flowmeter-system components and make connections per manufacturer's written instructions.

I. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted. Furnish copies of manufacturers' wiring diagram submittals to electrical Installer.

3.3 CONNECTIONS

A. Piping installation requirements are specified in Division 21 Section "Water-Based Fire-Suppression Systems." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to pumps and equipment to allow service and maintenance.

C. Connect water supply and discharge piping to fire pumps. Connect water supply and discharge piping to pressure-maintenance pumps.

D. Connect relief-valve discharge to point of disposal.

E. Connect flowmeter-system sensors and meters per manufacturer's written instructions.

F. Connect controllers to pumps.

G. Connect fire-pump controllers to building fire-alarm system.

H. Ground equipment per Division 26 Section "Grounding and Bonding for Electrical Systems."

I. Connect wiring per Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform field tests for each fire pump when installation is complete. Comply with operating instructions and procedures in NFPA 20 to demonstrate compliance with requirements. Where possible, field correct malfunctioning equipment, then retest to demonstrate compliance. Replace equipment that cannot be satisfactorily corrected or that does not perform as indicated, then retest to demonstrate compliance. Verify that each fire pump performs as indicated.

C. Perform the following field tests and inspections and prepare test reports:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Final Checks before Startup: Perform the following preventive-maintenance operations and checks:

    a. Lubricate oil-lubrication-type bearings.

b. Remove grease-lubrication-type bearing covers, flush bearings with kerosene, and clean thoroughly. Fill with new lubricant according to manufacturer's written instructions.
c. Disconnect coupling and check diesel motor for proper rotation. Rotation shall match direction of rotation marked on pump casing.
d. Verify that pump is free to rotate by hand. If pump is bound or if it drags even slightly, do not operate until cause of trouble is determined and corrected.

3. Starting procedure for pumps is as follows:

a. Prime pump by opening suction valve and closing drains and prepare pump for operation.
b. Open sealing-liquid supply valves if pump is so fitted.
c. Start motor.
d. Open discharge valve slowly.
e. Observe leakage from stuffing boxes and adjust sealing-liquid valve for proper flow to ensure lubrication of packing. Do not tighten gland immediately, but let packing run in before reducing leakage through stuffing boxes.
f. Check general mechanical operation of pump and motor.

4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
5. Furnish fire hoses in number, size, and length required to reach storm drain or other acceptable location to dispose of fire-pump test water. Fire hoses are for field-acceptance tests only and are not property of Owner.

3.5 DEMONSTRATION

A. The system manufacturer or certified factory-trained representative shall provide start-up of the fire pump system per NFPA 20, Section 11-2. This start-up shall include verification of proper installation, system initiation, adjustment, and fine-tuning. Start-up shall not be considered complete until the sequence of operation, including all alarms, has been sufficiently demonstrated to the owner or owner's designated representative. This job site visit shall occur only after all hook-ups, tie-ins, and terminations have been completed and signed-off on the manufacturer's start-up request form.

B. The system manufacturer or factory-trained representative shall provide on-site training for owner's personnel to adjust, operate, and maintain fire pumps, drivers, controllers, and pressure-maintenance pumps. Refer to Division 01 Section “Demonstration and Training”.

C. This training shall fully cover maintenance and operation of all system components.

END OF SECTION 213000

Construction Documents 6/24/24

SECTION 220500

PLUMBING GENERAL

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 (General Requirements) sections of the Project Manual apply to this Section.

B. The General Conditions shall be carefully examined before proposals for any work are submitted. Division 22 shall not be interpreted as waiving or overruling any requirements expressed in the General Conditions unless Division 22 sections contain statements more definitive or more restrictive.

1.2 SCOPE

A. Provide all labor, material, equipment and services necessary and reasonably incidental to the proper completion and proper operation of the building plumbing systems. The work shall consist of but shall not necessarily limited to the following:

1. Domestic water system including extension of piping and connections to all fixtures and/or equipment. The domestic water system shall be extended from a point 5 (five) feet beyond the exterior face of the building.

2. Sanitary drain, waste and vent system including extension of piping and connection to all fixtures and/or equipment. The sanitary system shall be extended to a point 5 (five) feet beyond the exterior face of the building.

3. Rainwater collection system including extension of piping to roof drains. The rainwater collection system shall be extended to a point 5 (five) feet beyond the exterior face of the building.

4. Natural Gas system including extension of piping and connections to gas fired plumbing equipment, kitchen equipment, HVAC equipment, etc. The natural gas system shall extend from the gas meter, by service provider, to the building.

1.3 DEFINITIONS

A. Words and phrases used throughout the Contract Documents shall be interpreted as indicated below:

1. Construction Documents – the basis for the work. It includes both the Drawings (plans) and Project Manual (specifications).

2. Contractor – The person or organization awarded the contract for construction services.

In the case of a construction project administered as a multiple-prime contract, the term shall be further defined as the Contractor holding a prime contract for plumbing construction work.

The term “Plumbing Contractor” is used interchangeably with the term “Contractor”.

3. Provide – To furnish and install materials, equipment or systems.

4. Submittals – Submittals shall include Manufacturer's Catalog Data, Shop Drawings, Calculations, Certificates of Compliance, Testing Reports, Samples, and Operation and Maintenance Manuals.

5. Professional – The Architect and/or Engineer of record.

6. Work By Others – Work provided by a person or organization other than the Contractor.

1.4 CODES, REFERENCES AND STANDARDS

A. The Contractor shall comply with all laws, ordinances, and regulations of all Authorities Having Jurisdiction, including those of all applicable City, County, State, Federal and Public Utility entities. All licenses, permits, fees, connection fees, tapping fees, inspection fees, etc., shall be obtained by the Contractor and the cost shall be included in the Contract price.

B. The minimum standard of work under this contract shall be in accordance with the following model building codes:

1. North Carolina State Building Codes 2018 Edition:

a. North Carolina State Building Code.

b. North Carolina State Plumbing Code.

c. North Carolina State Mechanical Code.

d. North Carolina State Fire Prevention Code.

e. North Carolina State Fuel Gas Code.

f. North Carolina State Energy Code.

C. Other publications listed throughout Division 22 form a part of this specification to the extent referenced. All publications shall be the latest edition as adopted by the Authority Having Jurisdiction. The publications are referred to in the text by basic designation only.

1.5 QUALITY ASSURANCE, WORKMANSHIP AND COORDINATION

A. The Contractor must coordinate his work with that of the other trades so that all work will be performed in an orderly manner and with the least possible interference. Where coordination with other trades is required, the Professional shall make the final decision regarding changes to be made in the work.

B. The Contractor must thoroughly familiarize himself with all the Construction Documents for the project so that he clearly understands his responsibility in relationship to the work to be performed. The Contractor must plan and perform his work to permit the use of the building as soon as possible.

C. The Contractor shall guarantee the workmanship, materials, and equipment, furnished against defects, leaks, performance and non-operation for a period of one (1) year after

the date of final acceptance. Defective workmanship shall be construed as meaning defective materials and unsatisfactory installation and not intended to apply to ordinary wear and tear. The Contractor shall pay for any repairs or replacements caused by defective workmanship as construed herein within the period covered by the Guarantee, including all incidental work required to correct the deficiency.

D. The Contractor shall expressly and completely follow all manufacturers' instructions required for validation of the manufacturer's warranty agreement including but not limited to service, maintenance and adjustments of the equipment.

E. The Contractor shall be held responsible for the proper installation of all materials and equipment required for a complete installation within the intent and meaning of the Contract Documents.

1.6 PROJECT RECORD DRAWINGS

A. Changes from the Contract Drawings necessary to coordinate the work with other trades, to conform to the building conditions or to conform to the rules and regulations of Authorities Having Jurisdiction shall be made only after obtaining written permission from the Professional.

B. The Contractor shall keep a record of construction changes and deviations from the original Contract Drawings. All changes shall be recorded on a separate set of prints which shall be kept at the job site specifically for that purpose. The record shall be made immediately after the work is completed. Documentation shall include:

1. location and elevation of new and existing utility lines
2. points of connection to existing utility lines
3. changes in pipe routing location
4. valve locations
5. equipment locations, etc.
6. actual capacities and values of equipment provided as indicated in equipment schedules

C. The marked-up record set of drawings shall be delivered to the Professional before final acceptance of the Plumbing Contract work.

1.7 FIELD MEASUREMENTS

A. It shall be the Contractor's responsibility to verify the location of any and all existing underground utilities in the vicinity of his work. When it has been indicated that these utilities are to remain in place, the Contractor shall provide adequate means of support and protection during excavation operations.

B. Before ordering any equipment and material, or performing any work, the Contractor shall verify all measurements and dimensions at the job site and shall be held responsible for the correctness of same.

C. No extra compensation will be allowed because differences between actual dimensions and measurements and those indicated on the drawings.

D. Any difference which may be found shall be submitted to the Professional for consideration before proceeding with the work.

1.8 PROTECTION OF SERVICES AND EQUIPMENT

A. The Contractor, at his own expense, shall repair, replace and maintain in service any utilities, facilities or services (underground, aboveground, interior or exterior) damaged, broken, or otherwise rendered inoperative during construction due to activities on the part of the Contractor. The method used by the Contractor in repairing, replacing or maintaining the services shall be approved by the Professional.

B. The Contractor shall protect, at his own expense, such of his work, materials or equipment that is subject to damage during the project duration. All openings into any piping, ducts or equipment must be securely covered, or otherwise protected, to prevent injury due to carelessly or maliciously dropped tools or materials, grit, dirt, or any foreign material. The Contractor shall be held responsible for all damage so done until his work is fully and finally accepted.

C. It shall be the responsibility of the Contractor to protect motors, pumps, electrical equipment, and all similar items of equipment from dirt, grime, plaster, water, etc. during all phases of construction. This protection shall be provided by covering equipment with transparent plastic sheeting and/or locating the materials and equipment in an area free from the elements.

1.9 INTERRUPTION OF SERVICES

A. The Contractor shall schedule his work to avoid any major interruption of any utility services.

B. Existing utilities serving facilities occupied and used by the Owner or others shall not be interrupted except when such interruptions have been authorized in writing by the Owner or the Professional. Interruptions shall occur only after acceptable temporary utility services have been provided. The Contractor shall provide a minimum of ten (10) working days notice to the Professional and receive written notice to proceed before interrupting any utility.

1.10 CLEANUP

A. The Contractor shall maintain buildings, grounds and public properties free from accumulations of waste materials, debris and rubbish. At reasonable intervals during the progress of work, and when directed by the Owner's Authorized Representative, the site and public properties shall be cleaned and waste materials, debris and rubbish shall be disposed of in appropriate manner. The Contractor shall provide containers for collection of waste materials, debris and rubbish. Waste materials, debris and rubbish shall be removed from the job site and legally disposed of at a landfill area in accordance with all applicable regulations. Burning or burying waste materials, debris or rubbish on project site shall not be permitted.

B. At the completion of the Project, remove waste materials, rubbish, tools, equipment, machinery, surplus materials, etc., and clean all sight-exposed plumbing fixtures and

equipment. Remove grease, dust, dirt, stains, labels, fingerprints and other foreign materials from sight-exposed plumbing fixtures and equipment. Broom clean paved and concrete surfaces; rake clean other ground surfaces. Repair, patch and touch up marred surfaces to specified finish or to match adjacent surfaces.

1.11 SUBMITTALS

A. Submittals shall be in accordance with Division 01 of the Project Manual.

B. General

1. The Contractor shall provide to the Professional for review electronic (pdf file format) copies of required submittals, unless noted otherwise. All Catalog Data, Shop Drawings, Calculations, and Certificates of Compliance shall be submitted as a single package. Failure of the contractor to provide a complete submittal package may result in delay in processing time. All such delays to the job resulting from the contractor's failure to provide submittals at one time will be the responsibility of the Contractor. Submittals will be returned to the Architect / Contractor. Submittals shall clearly identify the contract documents specification section or drawing referenced, identifying and highlighting each item to be reviewed.

2. Submittals provided for review shall clearly and completely describe the specific product(s) they represent. Where differences exist between the item specified and that submitted for review, the submittal shall be highlighted.

3. Submittals shall bear the review stamp of the Contractor. The review stamp of the Contractor shall be affixed to shop drawings to indicate:

   a. The Contractor has coordinated the electrical characteristics of the equipment.

   b. The Contractor has verified that the equipment submitted will physically fit into the space allocated with adequate clearances for maintenance, access, and egress requirements.

   c. The Contractor shall bear all associated costs that may accrue due to failure to completely represent a given product.

4. Material and equipment shown on the drawings or specified herein shall not be incorporated in the work of this Contract until shop drawings, engineering data and catalog information have been reviewed and accepted by the Professional.

C. Trade Name References

1. Material and equipment are described and listed in the Project Documents by trade name, by manufacturer's name and model number, or by performance attributes. It is intended that trade names or manufacturer's names shall establish standards of quality, performance, capacity, materials, and design for the item specified.

2. Where more than one manufacturer is listed for an item, those mentioned are considered equivalent if the quality, style, capacities, materials and performance of the specified item are equivalent. All materials and equipment shall be subject to the acceptance by the Professional.

D. Substitutions

1. No substitution shall be made without the review and acceptance by the Professional.

2. Where the phrase “or accepted substitute” or “or equal” appears in the Contract Documents, it shall refer to the requirement of acceptance by the Professional of the material or equipment involved.

3. It shall be the responsibility of the Contractor to ensure that each manufacturer can furnish a substitute in complete conformity with the requirements of this Project. The Contractor shall assume all costs or extra charges associated with the substitution, including: any architectural, structural, mechanical, or electrical changes required, costs in connection with work of the other trades necessitated substitutes, and any additional engineering costs required.

4. The Contractor shall indicate the specified equivalent on shop drawings or catalog data which are submitted as substitutions.

5. At the request of the Professional samples of items that are to be used in substitution of specified items shall be submitted. If such a request is made, a sample of both the specified item and the proposed substitute item shall be submitted simultaneously. The scheduling of the submission of such samples shall be as directed and shall in no way delay the progress of the project. The Professional will assume no liability whatsoever for any samples submitted.

E. Operation and Maintenance Manuals

1. Submit two (2) sets of 8-1/2” x 11” text sixty (60) days prior to operator training/pre-final inspection bound in three D side ring capacity expansion binders with durable plastic covers for review by the Professional.

2. Prepare binder covers with printed title “OPERATION AND MAINTENANCE INSTRUCTIONS”, title of project, and subject matter of binder when multiple binders are required.

3. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.

4. Contents: Prepare a Table of Contents for each volume, with each Product or system description identified type on thirty (30) pound white paper.

   a. Part 1: Directory, listing names, addresses, and telephone numbers of Professional, Contractor, Subcontractors, and equipment suppliers.

   b. Part 2: Operation and maintenance instructions arranged by system or process floor and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:

      1) Significant design criteria.

      2) List of equipment.

      3) Parts list for each component.

4) Maintenance instructions for equipment and systems.

5) Maintenance instructions for finishes, including recommended cleaning methods and materials and Operating instructions.

6) Special precautions identifying detrimental agents.

7) Special Requirements of other sections of this specification noted to be included in the operating and maintenance manual.

c. Part 3: Project documents and certificates, including the following:

1) All approved Submittals

2) Certificates of Compliance

3) Photocopies of warranties and bonds

4) Material safety data sheets

5. Submit five (5) copies of completed volumes in final form fifteen (15) days prior to owner training. These copies will include Professional's previous review comments.

6. Submit eight final volumes revised, within ten (10) days after pre-final observation.

F. Samples

1. The Contractor shall furnish, for review by the Professional, all samples specified or requested by the Professional. The finished work shall match accepted samples and shop drawings.

1.12 ELECTRICAL EQUIPMENT

A. The Contractor shall furnish all motors, combination starters/disconnects, overload protection and controls for equipment required to provide complete and workable systems, unless noted otherwise.

B. All motors, motor control equipment and wiring shall meet the requirements of the National Electric Code, and shall comply with the requirements of the Public Utility Company furnishing service and with the rules and regulations of all Authorities Having Jurisdiction.

C. The contractor shall verify electrical characteristics at the site before ordering electrical equipment.

D. Motors under ½ (one-half) horsepower shall be 120 volts. Motors ½ (one-half) horsepower and over shall be 3 (three phase. All motors to be 1750 revolutions per minute (rpm) unless noted otherwise. Combination motor starters shall of the fused switch type to complete with magnetic motor starter. Units shall be of the NEMA size and type applicable to motor size, with 3-pole overload. Overload elements and fuses shall be of the proper size to protect the motor. Unless noted otherwise, units shall be equipped with indicating lights, HAND-OFF-AUTOMATIC (HOA) selector switch, 4 (four) auxiliary contacts 2 (two) normally open (N.O.) and 2 (two) normally closed (N.C.) and fused control transformer to provide 120-volt control voltage. Fusible

disconnect switch operating handles shall be interlocked with the door so that the door cannot be opened with the switch in the "ON" position, except through a hidden release mechanism. The operating handle shall be arranged for padlocking in the "OFF" position with up to three padlocks. Fuses shall be furnished by the Contractor as required to comply with NEC requirements. Where R type fuses are indicated, fuse holders shall be provided with rejection clips. Equipment shall be Square D, Allen-Bradley, or General Electric or accepted substitute, and shall be provided with a NEMA Type 1 enclosure, unless noted otherwise.

1.13 CONTROL WIRING

A. The Contractor shall provide all necessary control wiring and related conduit required for complete and workable systems.

B. All conduit and wiring shall be in accordance with the latest edition of the National Electrical Code. Installation of control wiring shall be performed in a neat and workmanlike manner by competent workmen. Workmanship shall be as specified in Division 26.

C. Control circuits shall be wired for 110-volt control, using fused individual control transformers. Circuits shall be fused and shall be interrupted when the disconnect device is opened.

1.14 EXCAVATION, BACKFILLING AND COMPACTION

A. Excavation, Backfilling and Compaction shall comply with Division 31 of the Project Manual

B. General

1. The Contractor shall notify one call prior to any work.

2. The Contractor shall perform all excavation, backfilling, compaction and necessary finishing for all piping, equipment, and accessories. Piping installation shall be in accordance with local water, sewer and gas utility regulations and applicable State and Local codes.

3. Protect existing structures, utilities, sidewalks, pavements and other facilities not indicated for removal, from damage caused by settlement, lateral movement, undermining, washout and other hazards resulting from excavation operations.

4. Existing utility lines shown on the Project Documents may not indicate the exact in-place location of the lines. They do not show every pipe, fitting or appurtenance that may exist at the project site. The location and depth of all utilities shall be marked and recorded prior to any excavation. Should uncharted or incorrectly charted, existing piping or other utilities be uncovered during excavation, contact the Professional immediately for directions before proceeding further with work in this area. Cooperate with owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to the satisfaction of the utility owner.

5. If it becomes necessary to install any lines or equipment in locations other than those shown, the Professional's acceptance shall be obtained before starting the excavation.

6. The presence of explosives on the project site or the use of explosives in the execution of the work under this contract is not permitted.

C. Excavation

1. All plumbing excavation is unclassified.

a. Paved Areas – When working within the right-of-way limits of all North Carolina State highways, backfilling must be in conformance with the requirements of the North Carolina Department of Transportation, which is made a part of these specifications by this reference thereto.

D. Compaction

1. Comply with Division 31 of the Project Manual.

1.15 CONCRETE

A. Comply with Division 03 of the Project Manual.

B. Reinforcing shall conform to ASTM A-615, Grade 60. Concrete exposed to freezing and thawing, salts, sulfates and corrosion shall comply with International Building Code with North Carolina amendments.

C. All concrete shall be of minimum 3000 pounds per square inch (psi) strength in 28 (twenty-eight) days. All concrete shall be mixed by machine. No wet or moistened mixture containing cement shall remain unplaced for a period exceeding 30 (thirty) minutes and shall not be used after its initial set. Re-tempering after initial set is prohibited. Exposed surfaces shall be protected from drying for at least 7 (seven) days. All forms shall be built true and rigid. Form removal shall not injure the concrete.

D. All concrete is to be finished with a hard, smooth troweled finish and is to be faced smooth with rounded corners.

1.16 INSPECTION AND TESTING

A. General

1. New plumbing systems and parts of existing systems which have been altered, extended or repaired shall be tested to disclose leaks and defects.

2. The Contractor shall notify the Professional a minimum of 5 (five) working days prior to testing to coordinate the testing and inspection procedures.

3. If the Professional determines that the plumbing systems do not pass the prescribed tests, then the Contractor shall be required to make the necessary repairs, at his own expense, and the Contractor shall re-inspect and re-test the systems. Repairing, inspection and testing shall be continued until all systems pass as determined by the Professional.

4. All new, altered, extended or replaced plumbing shall be left uncovered and unconcealed until it has been inspected, tested and accepted by the Professional. Where such work has been covered, or concealed before it has been inspected, tested

and accepted, it shall be uncovered by the contractor, at his own expense as directed by the Professional.

5. All equipment, material, labor, etc., required for testing the plumbing systems shall be furnished by the Contractor.

B. Sanitary, Vent, and Rainwater Collection Systems

1. The system shall be tested in accordance with the North Carolina State Plumbing Code.

2. Rough Plumbing – Systems shall be tested upon completion of the rough piping installation and proved watertight. The water test shall be applied to the system either in its entirety or in sections after rough piping has been installed.

   a. Where applied to the entire system, all openings in the piping shall be closed, except the highest opening, and the system filled with water to point of overflow.

   b. Where the system is tested in sections, each opening shall be plugged, except the highest opening of the section under test, and each section shall be filled with water. A section shall not be tested with less than a 10-foot head of water.

   c. In testing successive sections, at least the upper 10-feet of the next preceding section shall be tested, such that a joint or pipe in the building, except the uppermost 10 feet of the system, shall not have been subjected to a test of less than a 10-foot head of water.

   d. The water shall be kept in the system or in the portion under test for a minimum of 2 (two) hours before inspection starts. The system shall then be inspected to ensure that it is tight at all points.

   e. The Contractor shall provide a written Test and Inspection Report that the above prescribed test(s) have been performed in accordance with these Specifications. The report is subject to approval by the Professional.

3. Finished Plumbing – After the plumbing fixtures have been set and their traps filled with water, the plumbing fixture connections shall be tested and proved gas and water tight.

   a. A smoke test shall be made by filling all traps with water and then introducing into the system smoke produced by one or more smoke machines. When the smoke appears at stack openings on the roof, the stack openings shall be closed and a pressure equivalent to a 1-inch water column shall be introduced and maintained for the period of the inspection.

   b. Where the local Authority Having Jurisdiction finds that a smoke test need not be performed, a peppermint test shall be performed. Two (2) ounces of oil of peppermint shall be poured into the roof terminal of every line or stack to be tested. The oil of peppermint shall be followed at once by 10 quarts of hot (140-degrees Fahrenheit) water. All roof vent terminals shall then be sealed. The system shall then be inspected for the detection of odor of

peppermint. If odor of peppermint is detected, repairs shall be made and the system shall be retested.

c. The above tests shall be witnessed by the Authority Having Jurisdiction or by Professional or his representative.

d. The Contractor shall provide a written Test and Inspection Report that the above prescribed test(s) have been performed in accordance with these Specifications. The report is subject to approval by the Professional.

C. Building Sewer

1. The building sewer shall be tested by insertion of a test plug at the point of connection with the public sewer. The building sewer shall then be filled with water under a head of not less than 10-feet. The water level at the top of the test head of water shall not drop for at least 15 (fifteen) minutes.

D. Domestic Water Systems

1. The system shall be tested either in its entirety or in sections.

2. The system shall be tested and proved tight under a water pressure of 125 pounds per square inch for a period of 2 hours.

3. Potable water shall be used for testing.

E. Fuel Gas Systems

1. The systems shall be tested in accordance with NFPA 54.

2. All fuel gas piping shall be pneumatically tested for tightness prior to commencement of gas service. Air or nitrogen shall be used as the test medium. The piping system shall be pressurized to 100 psig for a period of 2 hours. All joints shall be leak tested with detection solution while the system is pressurized. The Contractor shall provide a valved ¼ inch FPT connection in the system to which shall be attached a 24-hour pressure recording gauge. The Contractor shall arrange for a gas company representative to witness the test. Leaks shall be repaired by tightening or replacing joints. Caulking of joints is not permitted.

1.17 STERILIZATION OF THE DOMESTIC WATER SYSTEM

A. After the system has been tested and approved, the entire new system, including valves and accessories, shall be chlorinated. Disinfecting shall be in accordance with AWWA C651.

B. Chlorine may be applied in any of the following forms:

1. Liquid chlorine gas-water mixture

a. Chlorine gas-water mixture shall be applied by a solution feed chlorinating device.

2. Direct chlorine gas feed

a. Chlorine gas shall b fed directly from a chlorine cylinder with a suitable device for regulating the rate of flow and the effective diffusion of gas within the line.

3. Calcium hypochlorite and water mixture.

a. Calcium hypochlorite shall be HTH, Perchlorene and Maxochlor, or accepted substitute. A solution consisting of five (5%) percent powder to ninety-five (95%) percent water by weight shall be prepared. The calcium hypochlorite and water mixture, first made into a paste and then thinned to a slurry, shall be injected or pumped into the system.

C. The system or part thereof shall be filled with a water/chlorine solution containing at least 50 parts per million of chlorine, and the system or part thereof shall be valved off and allowed to stand for 24 hours; or the system or part thereof shall be filled with a water/chlorine solution containing at least 200 parts per million of chlorine and allowed to stand for 3 hours. During the chlorination process all valves and accessories shall be operated.

D. After the chlorination process, the chlorine shall be flushed from the system until the system water is equal in chemical and bacteriological composition to those of the permanent source of water supply.

E. Laboratory tests of the water shall be paid for by the Contractor.

1.18 INSTRUCTION OF THE OWNER

A. After acceptance of the Project, the Contractor shall furnish the services of personnel thoroughly familiar with the completed installation to instruct the Owner in the proper operation and maintenance of all equipment and appurtenances provided.

B. The Contractor shall provide the Owner with two weeks' notice before the instruction session.

1.19 CHASES AND OPENINGS

A. All chases and openings required for the installation of the work shall be coordinated with the other trades. The Contractor shall provide the other trades with sufficient time (1 (one) week minimum) for coordination of all chases and openings. The contractor shall be responsible for all work required to cut and patch the required openings. The work shall be performed to the satisfaction of the Professional.

B. Penetrations made in fire rated chases, partitions, floors, etc. shall be sealed with an approved material and method as required to maintain the integrity of the fire separation.

C. The Contractor shall provide all sleeves, hangers, and anchors required for installation of the work in chases and openings.

1.20 WATER SERVICE AND METERS

A. The Contractor shall coordinate water meter requirements in accordance with the local water utility regulations, including required permits, meters, piping, valves, by passes, supports and other accessories.

1.21 PAINTING

A. Painting shall be in accordance with Division 09.

1.22 RELATED WORK

A. All work related to providing complete plumbing systems and equipment shall be the responsibility of the Contractor. The following related work shall be provided as indicated in other specification Divisions, unless noted otherwise, but shall remain the responsibility of the Contractor for workmanship and completeness:

1. General Contractor

a. Installation of access panels.

b. Leaders and gutters.

c. New catch basins and foundation drains. Final connections shall be by the Contractor, as indicated on the drawings and as herein specified.

d. Final painting of existing walls, floors and ceilings where the surfaces are being refinished and remodeled under the General Contract. Refer to General Construction Drawings.

e. Equipment and furnishings including shop equipment and laboratory equipment. Final connections to all equipment and furnishings shall be provided by the Contractor. The Contractor shall be responsible for coordination of plumbing services with the equipment and furnishings.

f. Installation and flashing of roof penetrations including but not limited to roof drains, vents through roof, gas piping, etc. Final connections shall be provided by the Contractor.

g. Casework mounted sinks and lavatories, including faucets, bubblers, strainers, tailpieces, traps, gas cocks, and inter-connecting piping. The Contractor shall install the sinks, equipment and appurtenances and shall make final plumbing connections. Rough-in plumbing work shall be in accordance with rough-in drawings as furnished by the General Contractor Final connections to all fixtures shall be provided by the Contractor. The Contractor shall be responsible for coordination of plumbing services with the fixtures and equipment.

h. Concrete housekeeping pads for plumbing equipment.

i. Removal of existing concrete housekeeping pads.

2. Food Service Equipment Contractor

a. Food service equipment including food preparation equipment, hand washing sinks, dishwashing equipment, dishwasher booster heaters, wash-down kitchen hoods, refrigeration equipment, and sink traps and faucets. Final connections to all fixtures and equipment and all associated work including inter-connecting piping, fittings, valves, gauges, gas lines, flexible quick disconnects, and hose assemblies shall be provided by the Contractor. The

Contractor shall provide individual supply piping stops at each piece of equipment. All work shall be installed in accordance with the standards and requirements of the National Sanitation Foundation (NSF), the Department of Health and applicable plumbing codes. Rough-in plumbing work shall be in accordance with rough-in drawings as furnished by the Food Service Equipment Contractor. Final connections to all fixtures shall be provided by the Contractor. The contractor shall be responsible for coordination of the plumbing services with the food preparation equipment.

3. Mechanical Contractor

   a. Condensate drain piping.

4. Electrical Contractor

   a. Installation of all combination starters/disconnects and overload protectors.

1.23 MISCELLANEOUS STEEL AND ACCESSORIES

A. The contractor shall provide all necessary steel angles, channels, pipe, rods, nuts, bolts, etc., as shown on plans, as specified, or as may be required for complete and proper installation of plumbing fixtures, systems and equipment. All material and workmanship shall be of the best quality and shall be installed in accordance with the best practices of the trade.

1.24 ACCESS PANELS

A. The Contractor shall furnish access doors to the General Contractor for installation in ceilings, walls, partitions and floors for access to valves, traps, fittings, and all appurtenances.

B. Access panels shall be of sufficient size to permit removal or access to equipment, except that the minimum size shall be 12-inches by 16-inches.

C. Access door locations shall be as determined by field conditions for optimum access to equipment, and shall be reviewed by the Professional before final installation, and shall be subject to the following.

   1. Bottom of access doors shall not be lower than the top of the partition base, or a minimum of 6 inches above floor.

   2. Tops and/or sides of access panels shall be a minimum of 6-inches from the ceiling or opening or from the edge of a wall return.

D. Access doors shall be suitable for installation in the finish material of the ceilings, walls, partitions and floors.

E. Frame and panel access doors in restrooms, kitchens and as indicated shall be stainless steel.

F. Access doors with UL Listing shall be provided in rated construction assemblies. Access doors shall be “B-Label” and shall have a UL one and one-half (1-1/2) hour rating at 250 degrees F rating for both door and frame. Maximum size shall be 20” x 20” or 400 square inches in area. Frame shall be sixteen (16) gauge minimum steel, panel shall be

twenty (20) gauge minimum steel. Access doors shall be provided with a baked-on enamel finish (prime coat), continuous type hinge on one side, flush-face type lock with key operation and self-latching cylinder locks.

G. Access doors without UL label shall be provided in all non-rated construction assemblies: Frame shall be sixteen (16) gauge minimum steel, panel shall be fourteen (14) gauge minimum steel. Access doors shall be provided with a baked-on enamel finish (prime coat), concealed spring type hinges and flush-face type lock with key operation and self-latching cylinder locks. Door shall open 175 degrees (minimum).

H. All access doors shall be keyed alike.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials used on plumbing systems shall comply with the following lead ban requirements:

1. Solders with lead content exceeding 0.2% (two-tenths of a percent) are prohibited. Brass and bronze materials containing 8.0% (eight percent) or greater lead are prohibited.

PART 3 - EXECUTION

3.1 GENERAL

A. All materials and equipment used shall be installed in strict accordance with the Standards under which the materials are accepted and approved, and in strict accordance with the manufacturer's instructions.

B. The Contract Documents are not intended to indicate every bend, offset, change in direction and appurtenance required to provide a complete and workable system.

C. The contract drawings are diagrammatic and are indicative of the work to be performed. It is not intended that they show every pipe, fitting or apparatus required for a complete installation.

D. Except where otherwise indicated, minimum cover shall not be less than the following:

1. sanitary sewer piping: 3'-0"
2. storm sewers: 1'-0"
3. water piping: 3'-0"
4. gas piping: 2'-0"

3.2 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.3 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.4 SEISMIC RESTRAINTS

A. The Plumbing Contractor shall coordinate with the General Contractor to determine site classification and seismic requirements for this project. Where required, the Plumbing Contractor shall be responsible for providing restraints to resist the earthquake effects on the plumbing system(s). The requirements for these restraints are found in the 2018 North Carolina Building Code.

B. The Contractor shall refer to the latest edition of the “Seismic Restraint Manual Guidelines for Mechanical Systems” published by SMACNA for guidelines to determine the correct restraints for piping.

C. The Plumbing Contractor shall include shop drawings of the specific methods of seismic restraint to be used for this project before installation of piping, ductwork, and equipment.

D. Any required anchorage of the equipment and materials for this project shall be an integral part of the design and specification of such equipment and materials. Manufacturers of all equipment shall provide anchorage details, isolators, seismic mounts and restraints, etc. necessary to comply with Code requirements.

E. The Contractor shall retain the services of a Professional Structural Engineer licensed in the State of North Carolina to design seismic restraint elements required for this project. The engineer’s computations, bearing his professional seal, shall accompany shop drawings which show Code compliance. Computations and shop drawings shall be

submitted for review prior to the purchasing of materials, equipment, systems and assemblies.

F. Internal seismic restraint elements of manufactured equipment shall be certified by a Professional Engineer retained by the manufacturer. Such certificate applies only to internal elements of the equipment. All equipment anchorage requirements shall be coordinated with the building structure and shall be compatible thereto. All such anchorage shall be reviewed by the project's structural engineer.

G. The professional engineer retained by the Plumbing Contractor for seismic restraint calculations shall visit the job site upon completion of the seismic restraint installation. This Engineer shall provide in writing verification of compliance with the approved seismic submittal. This verification shall bear the Engineer's professional seal. Job site inspection by other than this Engineer is not acceptable. This engineer shall also be responsible for any required special inspections and associated documentation.

H. Review of the seismic design and shop drawings by the Engineer/Architect or his agent shall not relieve the Contractor of his responsibility to comply with the seismic or any other requirements of the International Building Code.

END OF SECTION 220500

Construction Documents 6/12/24

SECTION 220503

PLUMBING PIPE, TUBE AND FITTINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Pipe and pipe fittings for the following systems:

1. Domestic water piping within 5 feet of building.
2. Sanitary waste and vent piping, within 5 feet of building.
3. Storm water piping within 5 feet of building.
4. Equipment drains and over flows.
5. Natural Gas piping.
6. Flue and Combustion Air piping for sealed combustion, direct vent water heaters.
7. Unions and flanges.
8. Underground pipe markers.

B. Related Sections:

1. Division 08 - Access Doors and Frames
2. Division 09 - Painting
3. Section 22 05 23 - General-Duty Valves for Plumbing Piping.
4. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment.
5. Section 22 07 00 - Plumbing Insulation.
6. Division 31 - Excavation, Trenching and Backfill

1.2 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

B. ASTM International:

1. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
2. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.
3. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes.
4. ASTM B75 - Standard Specification for Seamless Copper Tube.

5. ASTM B88 - Standard Specification for Seamless Copper Water Tube.

6. ASTM B306 - Standard Specification for Copper Drainage Tube (DWV).

7. ASTM D1784 – Rigid Chlorinated Poly (Vinyl Chloride) (CPVC) Vinyl Compounds.

8. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

9. ASTM D2321 – Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.

10. ASTM D2665 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.

11. ASTM F441/F441M - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.

C. American Welding Society:

1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.

2. AWS D1.1 - Structural Welding Code - Steel.

D. American Water Works Association:

1. AWWA C104 - American National Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.

2. AWWA C151 - American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.

E. Cast Iron Soil Pipe Institute:

1. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

2. CISPI 310 – Standard Specification for Couplings for use with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

3. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe institute (CISPI) and be listed by NSF International.

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures.

B. Shop Drawings: Indicate layout of piping systems, including equipment, critical dimensions, and sizes.

C. Product Data: Submit data on pipe materials and fittings. Submit manufacturers catalog information.

D. Welders' Certificate: Include welders' certification of compliance with ASME Section IX.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with ASME B31.9 code for installation of piping systems and ASME Section IX for welding materials and procedures.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum five years documented experience.

B. Installer: Company specializing in performing work of this section with minimum 10 years documented experience.

C. Design pipe hangers and supports under direct supervision of Professional Engineer experienced in design of this Work and licensed at Project location

1.6 DELIVERY, STORAGE, AND HANDLING

A. Division 01 - Requirements for transporting, handling, storing, and protecting products.

B. Furnish temporary end caps and closures on piping and fittings. Maintain in place until installation.

C. Protect piping from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Division 01 - Environmental conditions affecting products on site.

B. Do not install underground piping when bedding is wet or frozen.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.9 COORDINATION

A. Division 01 - Requirements for coordination.

B. Coordinate installation of buried piping with trenching.

PART 2 PRODUCTS

2.1 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

Pipe 4 inches and larger:

A. Ductile Iron Pipe: AWWA C151.

1. Fittings: AWWA C110, ductile or gray iron, standard thickness.

2. Joints: AWWA C111, rubber gasket with rods.

Pipe 1 inch to 3 inch in size:

B. Copper Tubing: ASTM B88, Type K hard drawn or annealed.

1. Fittings: ASME B16.18, cast copper, or ASME B16.22, wrought copper.

2. Joints:

a. 2” and smaller: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F.

b. 2-1/2” and larger: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F.

Pipe 1 inch and smaller:

C. Copper Tubing: ASTM B88, Type K soft annealed seamless copper tubing (ASTM B88) with no joints.

2.2 DOMESTIC WATER PIPING, ABOVE GRADE

A. Copper Tubing: ASTM B88, Type L hard drawn.

1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.

2. Joints:

a. 2” and smaller: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F.

b. 2-1/2” and larger: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F.

3. Copper Press-Connect Fittings:

a. Basis of Design Product:

1) Viega Propress
2) Apollo Xpress
3) NIBCO

b. Fittings for NPS 2 and smaller: Cast-bronze or wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
c. Fittings for NPS 2-1/2 to NPS 4: Wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
d. Press Ends: Unpressed fitting identification feature to the fitting wall.
e. Sealing Element: EPDM.

2.3 SANITARY WASTE PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Cast Iron Soil Pipe: ASTM A74, service weight, bell and spigot ends.

1. Fittings: Cast iron, ASTM A74.

2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets.

B. Cast Iron Pipe: CISPI 301, hub-less.

1. Fittings: Cast iron, CISPI 301.

2. Joints: CISPI 310, ASTM C1540-15, Heavy-Duty assemblies of corrugated stainless-steel shield/housing, stainless steel bands with corrosion-resistant fasteners, and ASTM C 564 rubber sleeve with integral center stop.

a. Accepted Manufacturers:
1) NDS Clamp-All
2) Anaco-Husky
3) Mission Rubber Company
4) Mifab MI-QXHUB

Do not use PVC pipe for high temperature waste water (140° F or higher).

C. PVC Pipe: ASTM D2665, Schedule 40, solid wall, polyvinyl chloride (PVC) material, bell and spigot style solvent sealed joint ends.

1. Fittings: ASTM D2466, Schedule 40, PVC.

2. Joints: ASTM D2855, solvent weld with ASTM D2564 Solvent cement.

2.4 SANITARY WASTE AND VENT PIPING, ABOVE GRADE

A. Cast Iron Pipe: CISPI 301, hub-less, service weight.

1. Fittings: Cast iron, CISPI 301.

2. Joints: CISPI 310, ASTM C1540-15, Heavy-Duty assemblies of corrugated stainless-steel shield/housing, stainless steel bands with corrosion-resistant fasteners, and ASTM C 564 rubber sleeve with integral center stop.

a. Accepted Manufacturers:
1) NDS Clamp-All
2) Anaco-Husky
3) Mission Rubber Company
4) Mifab MI-QXHUB

B. Copper Tube: ASTM B306, DWV.

1. Fittings: ASME B16.23, cast bronze, or ASME B16.29, wrought copper.

2. Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F.

C. Copper Tube: ASTM B306, DWV.

1. Fittings: ASME B16.23, cast bronze, or ASME B16.29, wrought copper.

2. Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F.

2.5 GREASE WASTE PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Cast Iron Soil Pipe: ASTM A74, service weight [extra heavy], bell and spigot ends.

1. Fittings: Cast iron, ASTM A74.

2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets.

B. Cast Iron Pipe: CISPI 301, hub-less.

1. Fittings: Cast iron, CISPI 301.

2. Joints: CISPI 310, ASTM C1540-15, Heavy-Duty assemblies of corrugated stainless-steel shield/housing, stainless steel bands with corrosion-resistant fasteners, and ASTM C 564 rubber sleeve with integral center stop.

a. Accepted Manufacturers:
1) NDS Clamp-All
2) Anaco-Husky
3) Mission Rubber Company
4) Mifab MI-QXHUB

FOR WASTE LINES SERVING SODA MACHINES AND DISPOSERS ONLY:
Provide PVC waste pipe to a common sanitary waste main. Do not use PVC pipe for high temperature waste water (140° F or higher).

A. Epoxy Coated Cast Iron Pipe: CISPI 301, hub-less, service weight.

1. Epoxy Coated Fittings: Cast iron, CISPI 301.

2. Coating on pipe and fittings shall meet or exceed performance specifications per EN 877.

3. Pipe and fittings shall be equal to Charlotte Pipe Edge HP Iron for aggressive DWV applications.

4. Joints: CISPI 310, ASTM C1540-15, Heavy-Duty assemblies of corrugated stainless-steel shield/housing, stainless steel bands with corrosion-resistant fasteners, and ASTM C 564 rubber sleeve with integral center stop.

B. Plastic Pipe: ASTM D2665, Schedule 40, solid wall, polyvinyl chloride (PVC) material bell and spigot solvent sealed joint ends.

1. Fittings: PVC, ASTM D2466, Schedule 40, PVC.

2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

2.6 GREASE WASTE AND VENT PIPING, ABOVE GRADE

A. Cast Iron Pipe: CISPI 301, hub-less, service weight.

1. Fittings: Cast iron, CISPI 301.

2. Joints: CISPI 310, ASTM C1540-15, Heavy-Duty assemblies of corrugated stainless-steel shield/housing, stainless steel bands with corrosion-resistant fasteners, and ASTM C 564 rubber sleeve with integral center stop.

a. Accepted Manufacturers:

1) NDS Clamp-All
2) Anaco-Husky
3) Mission Rubber Company
4) Mifab MI-QXHUB

B. Copper Tube: ASTM B306, DWV.

1. Fittings: ASME B16.23, cast bronze, or ASME B16.29, wrought copper.

2. Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F.

2.7 STORM WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Cast Iron Pipe: ASTM A74, service weight, bell and spigot ends.

1. Fittings: Cast iron, ASTM A74.

2. Joints: ASTM C564, rubber gasket joint devices or lead and oakum.

B. Cast Iron Pipe: CISPI 301, hub-less, service weight.

1. Fittings: Cast iron, CISPI 301.

2. Joints: CISPI 310, ASTM C1540-15, Heavy-Duty assemblies of corrugated stainless-steel shield/housing, stainless steel bands with corrosion-resistant fasteners, and ASTM C 564 rubber sleeve with integral center stop.

C. PVC Pipe: ASTM D2665, Schedule 40 polyvinyl chloride (PVC) material, bell and spigot style solvent sealed joint ends.

1. Fittings: PVC, ASTM D2665.

2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

2.8 STORM WATER PIPING, ABOVE GRADE

A. Cast Iron Pipe: CISPI 301, hub-less, service weight.

1. Fittings: Cast iron, CISPI 301.

2. Joints: CISPI 310, ASTM C1540-15, Heavy-Duty assemblies of corrugated stainless-steel shield/housing, stainless steel bands with corrosion-resistant fasteners, and ASTM C 564 rubber sleeve with integral center stop.

2.9 EQUIPMENT DRAINS AND OVERFLOWS

A. Copper Tubing: ASTM B88, Type DWV.

1. Fittings: ASME B16.18, cast brass, or ASME B16.22 solder wrought copper.

2. Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F.

3. Fittings: ASME B16.18 cast copper alloy, or ASME B16.22 wrought copper and bronze, or ASTM B584 bronze sand castings with copper tube dimensioned grooved ends (flaring of tube and fitting ends to IPS dimensions is not permitted).

2.10 NATURAL GAS PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Steel Pipe: ASTM A53/A53M Schedule 40 black.

1. Fittings: ASTM A234/A234M forged steel welding type.

2. Joints: ASME B31.9, welded.

3. Jacket: AWWA C105 polyethylene jacket or double layer, half-lapped 10 mil polyethylene tape.

B. PE Pipe: ASTM D 2513, SDR 11.

1. PE Fittings: ASTM D 2683, socket-fusion type or ASTM D 3261, butt-fusion type with dimensions matching PE pipe.
2. PE Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D 2513, SDR 11; and steel pipe complying with ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
3. Anodeless Service-Line Risers: Factory fabricated and leak tested.
   a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet.
   b. Casing: Steel pipe complying with ASTM A 53/A 53M, Schedule 40, black steel, Type E or S, Grade B, with corrosion-protective coating covering. Vent casing aboveground.
   c. Aboveground Portion: PE transition fitting.
   d. Outlet shall be threaded or suitable for welded connection.
   e. Tracer wire connection.
   f. Ultraviolet shield.
   g. Stake supports with factory finish to match steel pipe casing or carrier pipe.
4. Transition Service-Line Risers: Factory fabricated and leak tested.
   a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet connected to steel pipe complying with ASTM A 53/A 53M, Schedule 40, Type E or S, Grade B, with corrosion-protective coating for aboveground outlet.
   b. Outlet shall be threaded or suitable for welded connection.
   c. Bridging sleeve over mechanical coupling.
   d. Factory-connected anode.
   e. Tracer wire connection.
   f. Ultraviolet shield.
   g. Stake supports with factory finish to match steel pipe casing or carrier pipe.

2.11 NATURAL GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M Schedule 40 black.

1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M forged steel welding type.

2. Joints: Threaded for pipe 2 inch and smaller; welded for pipe 2-1/2 inches and larger.

3. Press-Connect Fittings: Cold Press Mechanical Joint Fitting shall conform to material requirements of ASTM A420 or ASME B16.3 and performance criteria ANSI LC-4/CSA 6.32. Sealing elements for press fittings shall be HNBR. Sealing elements shall be factory installed or an alternative supplied

by fitting manufacturer. Press ends shall have SC (Smart Connect) technology design (leakage path). The function of this feature is to provide the installer quick and easy identification of connections which have not been pressed prior to putting the system into operation.

2.12 FLUE AND COMBUSTION AIR PIPING

A. Polypropylene Gas Venting System: Type BH Vent system.

1. The vent shall be of rigid single wall, factory built type, designed for use in conjunction with Category II or IV condensing or non-condensing gas fired appliances or as specified by the heating equipment manufacturer.

2. Maximum continuous flue gas temperature shall not exceed 230°F.

3. Vent shall be listed for a minimum positive pressure rating of 6" W.C. and shall have passed at 15" W.C.

4. The vent system shall be continuous from the appliance's flue outlet to the vent termination outside the building. All outside vent components must be UV rated if exposed to the atmosphere. All system components shall be ULC listed and supplied from the same manufacturer.

5. All system components such as vent supports, roof or wall penetrations, terminations, appliance connectors and drain fittings require to install the vent system shall be ULC listed and provided by the vent manufacturer.

6. Vent layout shall be designed and installed in compliance with manufacturer's installation instructions and all applicable local codes.

B. CPVC Pipe: ASTM F441, Schedule 40, chlorinated polyvinyl chloride (CPVC) material.

1. Fittings: ASTM F441, Schedule 40, CPVC.

2. Joints: solvent weld with ASTM F493 solvent cement.

C. Stainless Steel Vent System: UL 1738, AL29-4C.

1. All flue-gas carrying components of the vent system shall be obtained from a single manufacturer.

2. Stainless steel vent system shall be warranted by the manufacturer against defects in material and workmanship for a period of (15) years from the date of manufacture.

3. Vent shall be factory-built special gas type, single wall, engineered and designed for use on Category I, II, II, and IV appliances, or as specified by the equipment manufacturer.

4. Vent shall be constructed of AL29-4C or 29-4 (S44735) superferritic stainless steel with minimum thickness of 0.015" for diameters 3"-8" and 0.020" for diameters 10"-16".

5. All conduit components shall be manufactured from AL29-4C or 29-4 (S44735). The joint closure system shall be a Ring-and-Tab mechanism that is integral to each joint. Use of gasket lube, available from the factory, should be used for maximizing gasket life and ease of installation.

6. Joints shall be designed with a male and female overlapping metal-metal connection to maintain condensate on the AL29-4C stainless steel. Proper ¼" per foot pitch must be maintained at all times and condensate should flow back toward the appliance to the required number of drains.

7. Vent shall be rated for an internal static pressure of 9" w.g.

8. All parts shall be compatible with other single wall or double wall products of the same manufacturer.

2.13 UNIONS AND FLANGES

A. Unions for Pipe 2 inches and Smaller:

1. Ferrous Piping: Class 150, malleable iron, threaded.

2. Copper Piping: Class 150, bronze unions with soldered joints.

3. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

4. CPVC Piping: CPVC.

B. Flanges for Pipe 2-1/2 inches and Larger:

1. Ferrous Piping: Class 150, forged steel, slip-on flanges.

2. Copper Piping: Class 150, slip-on bronze flanges.

3. CPVC Piping: CPVC flanges.

4. Gaskets: 1/16-inch-thick preformed neoprene gaskets.

C. Flange Adapter for Pipe 2 inches and Larger:

1. Ferrous Piping: Class 125, 150 & 300, ductile iron, flat faced. Victaulic Style 741, 743 & W741.

2. Copper Piping: 300 psi, ductile iron coated with copper-colored enamel, flat faced. Victaulic Style 641.

D. PVC Pipe Materials: For connections to equipment and valves with threaded connections, furnish solvent-weld socket to screwed joint adapters and unions, or ASTM D2464, Schedule 80, threaded, PVC pipe.

PART 3 EXECUTION

3.1 EXAMINATION

A. Division 01 - Verification of existing conditions before starting work.

B. Verify excavations are to required grade, dry, and not over-excavated.

C. Verify trenches are ready to receive piping.

3.2 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.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.3 INSTALLATION - BURIED PIPING SYSTEMS

A. Verify connection to site piping system size, location, and invert are as indicated on Drawings.

B. Establish elevations of buried piping with not less than 2 ft of cover.

C. Establish minimum separation from other services in accordance with applicable codes.

D. Install plastic pipe as required per ASTM D2321.

E. Install pipe to elevation as indicated on Drawings.

F. Install pipe on prepared bedding.

G. Route pipe in straight line.

H. Install pipe to allow for expansion and contraction without stressing pipe or joints.

I. Install plastic ribbon tape continuous, buried 12 inches below finish grade and above pipe line; coordinate with Division 31. Refer to Section 22 05 00.

J. Pipe Cover and Backfilling:

1. Backfill trench in accordance with Section 22 05 00.

3.4 INSTALLATION - ABOVE GROUND PIPING

A. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

B. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.

C. Group piping whenever practical at common elevations.

D. Sleeve pipe passing through partitions, walls and floors. Refer to Section 22 05 29.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

F. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 22 07 00.

G. Provide access where valves and fittings are not accessible. Coordinate size and location of access doors with Division 08.

H. Install non-conducting dielectric connections wherever jointing dissimilar metals.

I. Establish invert elevations, slopes for drainage to 1/8 inch per foot minimum (1/4 inch per foot for 2" pipes). Maintain gradients.

J. Slope piping and arrange systems to drain at low points.

K. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

L. Install piping penetrating roofed areas to maintain integrity of roof assembly.

M. Install valves in accordance with Section 22 05 23.

N. Insulate piping. Refer to Section 22 07 00.

O. Install pipe identification in accordance with Section 22 05 53.

P. Press-Fitting joint systems shall be installed in accordance with manufacturerer's guidelines and recommendations. Contractor shall be trained by manufacturer for Press-Fittings application.

3.5 INSTALLATION - DOMESTIC WATER PIPING SYSTEMS

A. Install domestic water piping system in accordance with ASME B31.9.

B. Pipes carrying pressurized water and laid under the building shall be installed with NO joints.

3.6 INSTALLATION - SANITARY WASTE AND VENT PIPING SYSTEMS

A. Install sanitary waste and vent piping systems in accordance with ASME B31.9.

B. Install sanitary waste and vent piping systems in accordance with local plumbing code.

C. Install bell and spigot pipe with bell end upstream.

D. Support cast iron drainage piping at every joint.

3.7 INSTALLATION - STORM DRAINAGE PIPING SYSTEMS

A. Install storm drainage piping systems piping in accordance with ASME B31.9.

B. Install storm drainage piping systems in accordance with local plumbing code.

C. Install bell and spigot pipe with bell end upstream.

D. Support cast iron drainage piping at every joint.

3.8 INSTALLATION - GAS PIPING SYSTEMS

A. Install natural gas piping in accordance with NFPA 54.

B. Provide support for utility meters in accordance with requirements of utility company.

C. Install vent piping from gas pressure reducing valves to outdoors and terminate in weatherproof hood.

D. Install gas pressure regulator vent full size opening on regulator and terminate outdoors or as indicated on Drawings.

3.9 FIELD QUALITY CONTROL

A. Refer to Division 01 - Execution and Closeout Requirements: Field inspecting, testing and adjusting.

B. Test domestic water piping system in accordance with applicable code. Refer to Section 22 05 00.

C. Test sanitary waste and vent piping system in accordance with applicable code. Refer to Section 22 05 00.

D. Test storm drainage piping system in accordance with applicable code. Refer to Section 22 05 00.

E. Pressure test natural gas piping in accordance with NFPA 54.

3.10 CLEANING

A. Division 01 – Execution and Closeout Requirements: Field inspecting, testing and adjusting.

B. Clean and disinfect domestic water distribution system in accordance with Section 22 05 00.

END OF SECTION 220503

Construction Documents 6/12/24

SECTION 22 0515
PLUMBING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cleanouts
2. Floor Drains and Floor Sinks
3. Roof Drains
4. Discharge Spouts
5. Hose Bibbs
6. Wall Hydrants
7. Trap Primers
8. Backflow Preventers
9. Water Hammer Arrestors
10. Thermometers
11. Pressure Gauges
12. Grease Interceptors
13. Gas Pressure Regulators
14. Gas Specialties
15. Balancing Valves
16. Thermostatic Mixing Valves

B. Related Sections:

1. Division 08 - Access Doors and Frames
2. Division 09 – Painting
3. Section 22 05 03 – Plumbing Pipe, Tube and Fittings
4. Section 22 05 23 - General-Duty Valves for Plumbing Piping.
5. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment.
6. Section 22 07 00 - Plumbing Insulation.
7. Division 31 - Excavation ,Trenching and Backfill

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for grease interceptors.

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures.

B. Product Data: Submit data on pipe materials and fittings. Submit manufacturers catalog information.

1.4 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum five years documented experience.

B. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

C. All domestic water specialties shall be Lead-Free compliant products designed and manufactured to comply with ANSI / NSF 372 and NSF 61, Annex G.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Division 01 - Requirements for transporting, handling, storing, and protecting products.

B. Furnish temporary end caps and closures on piping and fittings. Maintain in place until installation.

C. Storage of Specialties on site – Specialties not be exposed to the elements and shall not be stored directly on ground.

1.6 DEFINITIONS

A. FOG: Fats, oils, and greases.

B. FRP: Fiberglass-reinforced plastic

C. HDPE: High-density polyethylene plastic

D. PE: Polyethylene plastic

E. PP: Polypropylene plastic

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Floor Cleanouts

1. Approved manufacturers: Zurn, JR Smith, Wade

2. Coated cast-iron body, gas and watertight ABS tapered thread plug, and round scoriated secured nickel bronze top adjustable to finished floor.

3. Carpeted Areas: Provide cleanout with carpet marker.

4. Tile Floor Areas: Provide cleanout with square top recessed for 1/8" tile.

5. Terrazzo Floor Areas: Provide cleanout with round top recessed for 1-1/4" terrazzo.

6. Standard: ASME A112.36.2M

7. Size: Same as connected branch up to 4". Use 4" cleanouts for connected branch sizes larger than 4".

B. Wall Cleanouts

1. Approved manufacturers: Zurn, JR Smith, Wade

2. Standard: ASME A112.36.2M

3. Size: Same as connected drainage piping up to 4".

4. Round stainless steel wall access cover with securing screw and bronze raised head plug.

C. Exposed Piping Cleanouts

1. Approved manufacturers: Zurn, JR Smith, Wade

2. Countersunk, bronze cleanout plug.

2.2 FLOOR DRAINS AND FLOOR SINKS

A. Approved manufacturers: Zurn, JR Smith, Wade

B. Coated cast-iron body unless otherwise indicated.

C. Provide floor drain and floor sink with deep seal p-trap.

D. Kitchen Areas – Provide stainless steel floor drains and floor sinks as specified on drawings.

2.3 ROOF DRAINS

A. Approved manufacturers: Zurn, JR Smith, Wade

B. Roof drains shall be provided by the Plumbing Contractor and installed by the General Contractor. The Plumbing Contractor shall insulate the roof drain body and provide connection of the roof drain piping to the roof drain outlet.

C. 15" diameter roof drain, dura-coated cast-iron body with combination membrane clamp / gravel guard and low silhouette aluminum dome. Provide roof drain with deck plate and adjustable extension.

D. Provide secondary roof drain with 4" high water dam.

2.4 DISCHARGE SPOUTS

A. Approved manufacturers: Zurn, JR Smith, Wade

B. Nickel bronze body, threaded inlet and decorative face of wall flange and outlet nozzle.

2.5 HOSE BIBBS

A. Approved manufacturers: Woodford, Zurn, JR Smith

2.6 WALL HYDRANT

A. Approved manufacturers: Woodford, Zurn, JR Smith

2.7 TRAP PRIMERS

A. Approved manufacturers: Precision Plumbing Products (PPP), Sioux Chief, MIFAB

B. Provide Trap Guards where allowed by Authority Having Jurisdiction. Waterless inline Trap Guard conforming to ASSE 1072 equal to Recotorseal "Sure Seal" Model SS3009V. Install Trap Guards in the outlet of the floor drain, not in the strainer.

2.8 BACKFLOW PREVENTORS

A. Approved manufacturers: Watts, Wilkins,

B. Backflow preventors shall be installed where shown on the drawings and conform to the type required by the local water authority.

C. Units shall be supported in accordance with manufacturer's recommendations.

D. Reduced Pressure Backflow Preventors – The assembly shall consist of an internal pressure differential relief valve located in a zone between two positive seating check modules with captured springs and silicone seat discs. Seats and seat discs shall be replaceable in both check modules and the relief valve. There shall be no threads or screws in the waterway exposed to line fluids. Service of all internal components shall be through a single access cover secured with stainless steel bolts. Body and shutoffs shall be constructed using Lead Free cast copper silicon alloy materials. Lead Free reduced pressure zone assembly shall comply with state codes and standards, where applicable, requiring reduced lead content. The assembly shall also include two resilient seated isolation valves, four resilient seated test cocks and an air gap drain fitting. The assembly shall meet the requirements of ASSE 1013.

2.9 WATER HAMMER ARRESTERS

A. Approved manufacturers: Precision Plumbing Products (PPP), Sioux Chief, Zurn

B. Water hammer arresters shall have sufficient volume of air to dissipate the calculated kinetic energy generated in the piping system. Arresters shall be effective when installed at any angle. Water hammer arresters shall be ANSI/ASSE 1010 2004 certified. Arresters shall be sized and placed per manufacturer's instructions.

2.10 THERMOMETERS

A. Approved manufacturers: Ernst Gage, Weiss Instruments, Weksler

B. 4 inch mercury type. Temperature range shall be 0°F to 200°F.

2.11 PRESSURE GAGES

A. Approved manufacturers: Ernst Gage, Weiss Instruments, Weksler

B. 4-1/2 inch dial, stainless steel and phosphor bronze movement, gauge cock and throttling device. Pressure range shall be 0 psi to 150 psi.

1. Operating point of gauge shall be on middle third of pressure rage.

2.12 GREASE INTERCEPTORS

A. Approved Manufacturers: Proceptor, Schier, Thermaco

B. GI-1 – Gravity Grease Interceptor – Elliptical Fiberglass (FRP) grease interceptor construction with inlet piping and baffle penetration designed to introduce wastewater in a tangential laminar flow pattern, to be appropriately sized based on anticipated usage and flow rates to meet applicable sanitary sewer discharge limits, including municipal by-laws.

1. Include accessways, tanks, and piping and baffle openings to retain grease and solids and to permit tangential laminar wastewater flow.

2. Factory installed Schedule 40 PVC cement welded type socket ports, or straight pipe, fitted into interceptor walls for each pipe connection.

3. Accessway Extension Collar:

a. Fiberglass risers, 24 inch

4. Accessway Frames and Covers: Round cover with non-slip cover finish, gasketed and non-vented top design.

a. Cast Iron: AASHTO M306 Traffic load rated. 24-inch diameter cover with 0.25” gasket. Two closed pickholes. Non-Bolted or Bolted option.

5. Watertight Flexible Caulking: Sikaflex 255 or Sikaflex 221 or approved alternate to provide watertight seal at extension collar joints.

6. Capacities and Characteristics: See Grease Interceptor Schedule on Drawings for continuation.

2.13 GAS PRESSURE REGULATORS

A. Approved Manufacturers: Rockwell, Fisher, Singer

B. Gas pressure regulators shall comply with ANSI Z21.80. Regulators shall be cast iron or die-cast aluminum construction with interchangeable zinc-plated steel springs, zinc-plated steel diaphragm plate, nitrile rubber seat disc, interchangeable aluminum orifice, and ultraviolet-stabilized mineral filled nylon seal plug. Regulator shall be single-port self-contained with orifice no larger than required at maximum pressure inlet and no pressure sensing piping external to the regulator. Pressure regulator shall maintain discharge pressure setting downstream and not exceed 150 percent of design discharge pressure at shutoff. Overpressure protection device shall be factory mounted on regulator. When using ventless regulators, mount regulator in a horizontal upright position. If vented type regulators are used, install vent piping (full size opening) from gas pressure regulators to outdoors and terminate in weatherproof hood.

2.14 MOTORIZED GAS VALVES

A. Automatic Gas Valves: Comply with ANSI Z21.21

1. Body: Brass or aluminum.
2. Seats and Disc: Nitrile rubber.

3. Springs and Valve Trim: Stainless Steel.
4. Normally closed.
5. Visual position indicator.
6. Electrical operator for actuation by appliance automatic shutoff device.
7. Valve shall be third party listed and labeled.

2.15 BALANCING VALVES

A. Approved Manufacturers: Bell & Gossett, Watts, TACO

B. Valves shall be designed to allow installing contractor to pre-set balance points for proportional system balance prior to system start-up in accordance with pre-set balance schedule.

C. Valves shall consist of Lead Free Brass / stainless steel ball construction with glass and carbon filled TFE seat rings. Valves shall have differential pressure read-out ports across valve seat area. Read-out ports to be fitted with internal EPT inserts/check valves. Valve bodies to have ¼" NPT tapped drain/purge port. Valves to have memory stop feature to allow valve to be closed for service and then reopened to set point without disturbing balance position. All valves shall have calibrated nameplates to assure specific valve settings. Valves shall be designed for positive shut-off. Valves shall be ANSI/NSF-61, Annex G compliant.

2.16 THERMOSTATIC MIXING VALVES

A. Approved Manufacturers: Leonard, Symmons, Lawler

B. Valves shall be ANSI/NSF-61, Annex G compliant.

C. Point of use mixing valves – Valve with bronze body, copper encapsulated thermostat, brass and engineered polymer internals, stainless steel spring, locking temperature adjustment knob (tamper-resistant), integral check valves on inlets, IPS or sweat connections, mounting bracket. Unit shall be ASSE 1070 listed and 3rd party certified as lead free.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install cleanouts in aboveground piping and building drain piping according to the following instructions unless otherwise indicated:

1. Use cleanouts the same size as drainage piping up to 4 inch. Use 4 inch for larger drainage piping unless larger cleanout is indicated.
2. Locate cleanouts at each change in direction of piping greater than 45 degrees.
3. Locate cleanouts at minimum intervals of 100 feet.
4. Locate cleanouts at the base of each vertical storm drain and waste stack.

B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

D. Install backflow preventers in each water supply to mechanical equipment and to other equipment and water systems that may be sources of contamination. Comply with the authorities having jurisdiction.

1. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to exterior of the building. Smaller make-up water backflow preventer drains may be routed to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
2. Do not install bypass piping around backflow preventers.

E. Install balancing valves in locations where they can easily be adjusted.

F. Install water-hammer arrestors in water piping according to PDI-WH 201.

G. Install air vents at high points of water piping.

H. Install grease interceptors according to manufacturer's installation instructions.

3.2 ADJUSTING

A. Set field adjustable flow set points of balancing valves.

B. Set field adjustable temperature set points of temperature-actuated, water mixing valves.

3.3 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

C. Protect materials stored on site from weather and theft. Do not store materials directly on ground.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test each pressure vacuum breaker and reduced pressure backflow preventer according to authorities having jurisdiction and the device's referenced standard.

B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 220515

Construction Documents 6/12/24

SECTION 220523

GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Ball valves.
2. Plug valves.
3. Check valves.

B. Related Sections:

1. Section 22 05 03 – Plumbing Pipe, Tube and Fittings
2. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment.
3. Section 22 07 00 - Plumbing Insulation

1.2 REFERENCES

A. ASTM International:

1. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
2. ASTM D4101 - Standard Specification for Propylene Injection and Extrusion Materials.

B. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP 67 - Butterfly Valves.
2. MSS SP 70 - Cast Iron Gate Valves, Flanged and Threaded Ends.
3. MSS SP 71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
4. MSS SP 78 - Cast Iron Plug Valves, Flanged and Threaded Ends.
5. MSS SP 80 - Bronze Gate, Globe, Angle and Check Valves.
6. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manufacturers catalog information with valve data and ratings for each service.

C. Manufacturer's Installation Instructions: Submit hanging and support methods, joining procedures.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of valves.

C. Operation and Maintenance Data: Submit installation instructions, spare parts lists, exploded assembly views.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Division 01 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

C. Provide temporary protective coating on cast iron and steel valves.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Division 01 - Product Requirements: Environmental conditions affecting products on site.

B. Do not install valves underground when bedding is wet or frozen.

1.8 WARRANTY

A. Division 01 - Execution and Closeout Requirements: Requirements for warranties.

B. Furnish five-year manufacturer warranty for valves excluding packing.

1.9 EXTRA MATERIALS

A. Division 01 - Execution and Closeout Requirements: Requirements for extra materials.

B. Furnish two packing kits for each size valve.

PART 2 PRODUCTS

2.1 BALL VALVES

A. Manufacturers:

1. Apollo Valves, Conbraco Company.
2. Crane Valve, North America.
3. Hammond Valve Model.
4. Jomar Valve

5. Milwaukee Valve Company.

6. NIBCO, Inc. Model.

7. Stockham Valves & Fittings Model.

8. Victaulic

B. 4 inch and Smaller: MSS SP 110, 600 psi WOG, two-piece brass or bronze body, chrome plated brass ball and stem, full port, PTFE seats, blow-out proof stem, solder or threaded ends, lever handle.

2.2 PLUG VALVES

A. Manufacturers:

1. DeZURIK, Unit of SPX Corp.

2. Flow Control Equipment, Inc.

3. Homestead Valve.

B. 2 inches and Smaller: MSS SP 78, Class 150, semi-steel construction, round port, full pipe area, pressure lubricated, Teflon packing, threaded ends. Furnish one plug valve wrench for every ten plug-valves with minimum of one wrench.

C. 2-1/2 inches and Larger: MSS SP 78, Class 150, semi-steel construction, round port, full pipe area, pressure lubricated, Teflon packing, flanged ends. Furnish wrench-operated.

2.3 CHECK VALVES

A. Spring Loaded Check Valves:

1. Manufacturers:

a. Apollo Valve, Conbraco Company

b. Crane Valve, North America.

c. Hammond Valve.

d. Milwaukee Valve Company.

e. NIBCO, Inc.

f. Stockham Valves & Fittings.

g. Victaulic Company.

2. 2 inches and Smaller: MSS SP 80, Class 250 bronze body, in-line spring lift check, silent closing, Buna-N disc, integral seat, solder or threaded ends.

3. 2-1/2 inches and Larger: MSS SP 71, Class 125, wafer or globe style, cast iron body, bronze seat, center guided bronze disc, stainless steel spring and screws, flanged ends.

PART 3 EXECUTION

3.1 EXAMINATION

A. Division 01 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify piping system is ready for valve installation.

3.2 INSTALLATION

A. Install valves with stems upright or horizontal, not inverted.

B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

C. Install 3/4-inch ball valves with cap for drains at main shut-off valves, low points of piping, bases of vertical risers, and at equipment.

D. Install valves with clearance for installation of insulation and allowing access.

E. Provide access where valves and fittings are not accessible. Coordinate size and location of access doors with Division 08.

F. Refer to Section 22 05 29 for pipe hangers.

G. Refer to Section 22 07 00 for insulation requirements for valves.

H. Refer to Section 22 05 03 for piping materials applying to various system types.

3.3 VALVE APPLICATIONS

A. Valves installed in the domestic water piping system shall be Lead-Free per NSF 61, Annex G or NSF 372 requirements.

B. Install shutoff and drain valves at locations indicated on Drawings in accordance with this Section.

C. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

D. Install globe valves for throttling, bypass, or manual flow control services.

E. Install spring loaded check valves on discharge of water pumps.

F. Install ball valves in domestic water systems for shut-off service.

G. Install globe valves in domestic water systems for throttling service.

END OF SECTION 220523

SECTION 220529

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe hangers and supports.
2. Hanger rods.
3. Inserts.
4. Flashing.
5. Sleeves.
6. Mechanical sleeve seals.
7. Formed steel channel.
8. Firestopping relating to plumbing work.
9. Firestopping accessories.
10. Equipment bases and supports.

B. Related Sections:

1. Section 22 05 03 – Plumbing Pipe, Tube and Fittings.
2. Division 03 - Concrete Forming and Accessories.
3. Division 03 - Cast-In-Place Concrete.
4. Division 07 - Joint Protection.
5. Division 09 - Painting and Coating.
6. Division 07 - Requirements for roof flashing installation.

1.2 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME B31.9 - Building Services Piping.

B. ASTM International:

1. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM E119 - Method for Fire Tests of Building Construction and Materials.
3. ASTM E814 - Test Method of Fire Tests of Through Penetration Firestops.

4. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.

5. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

C. American Welding Society:

1. AWS D1.1 - Structural Welding Code - Steel.

D. FM Global:

1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved by Factory Mutual Research for Property Conservation.

E. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.

2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.

3. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

F. Underwriters Laboratories Inc.:

1. UL 263 - Fire Tests of Building Construction and Materials.

2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

3. UL 1479 - Fire Tests of Through-Penetration Firestops.

4. UL 2079 - Tests for Fire Resistance of Building Joint Systems.

5. UL - Fire Resistance Directory.

1.3 DEFINITIONS

A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.4 SYSTEM DESCRIPTION

A. Firestopping Materials: shall comply with ASTM E119, ASTM E814, and/or UL 263, UL 1479 to achieve fire ratings as noted on Drawings for adjacent construction, but not less than 1 hour fire rating.

1. Ratings may be 3-hours for firestopping in through-penetrations of 4-hour fire rated assemblies unless otherwise required by applicable codes.

1.5 PERFORMANCE REQUIREMENTS

A. Firestopping: Conform to UL for fire resistance ratings and surface burning characteristics.

B. Firestopping: Provide certificate of compliance from authority having jurisdiction indicating approval of materials used.

1.6 SUBMITTALS

A. Division 01 - Submittal Procedures.

B. Product Data:

1. Hangers and Supports: Submit manufacturers catalog data including load capacity.

2. Firestopping: Submit data on product characteristics, performance and limitation criteria.

C. Firestopping Schedule: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.

D. Manufacturer's Installation Instructions:

1. Hangers and Supports: Submit special procedures and assembly of components.

2. Firestopping: Submit preparation and installation instructions.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.7 QUALITY ASSURANCE

A. Through Penetration Firestopping of Fire Rated Assemblies: UL 1479 or ASTM E814 with 0.10-inch water gage minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.

1. Wall Penetrations: Fire F-Ratings as indicated on Drawings, but not less than 1-hour.

2. Floor and Roof Penetrations: Fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.

a. Floor Penetrations within Wall Cavities: T-Rating is not required.

B. Through Penetration Firestopping of Non-Fire Rated Floor and Roof Assemblies: Materials to resist free passage of flame and products of combustion.

1. Noncombustible Penetrating Items: Noncombustible materials for penetrating items connecting maximum of three stories.

2. Penetrating Items: Materials approved by authorities having jurisdiction for penetrating items connecting maximum of two stories.

C. Fire Resistant Joints in Fire Rated Floor, Roof, and Wall Assemblies: ASTM E1966 or UL 2079 to achieve fire resistant rating as indicated on Drawings for assembly in which joint is installed.

D. Fire Resistant Joints Between Floor Slabs and Exterior Walls: ASTM E119 with 0.10-inch water gage minimum positive pressure differential to achieve fire resistant rating as indicated on Drawings for floor assembly.

E. Surface Burning Characteristics: 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

F. Perform Work in accordance AWS D1.1 for welding hanger and support attachments to building structure.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with 5 years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum 5 years documented experience.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Division 01 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

C. Protect from weather and construction traffic, dirt, water, chemical, and damage, by storing in original packaging.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Division 01 - Product Requirements: Environmental conditions affecting products on site.

B. Do not apply firestopping materials when temperature of substrate material and ambient air is below 60 degrees F.

C. Maintain this minimum temperature before, during, and for minimum 3 days after installation of firestopping materials.

D. Provide ventilation in areas to receive solvent cured materials.

1.11 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.12 WARRANTY

A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish five-year manufacturer warranty for pipe hangers and supports.

PART 2 PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Manufacturers:

1. Carpenter & Paterson Inc.
2. Creative Systems Inc.
3. Flex-Weld, Inc.
4. Glope Pipe Hanger Products Inc.

5. Michigan Hanger Co.

6. Superior Valve Co.

B. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized, hot-dip galvanized, or electro-galvanized.
3. Nonmetallic Coatings: Plastic coated or expoxy coated.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

C. Copper Pipe and Tube Haners:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

D. Plumbing Piping - DWV:

1. Conform to ASME B31.9, ASTM F708, MSS SP58, MSS SP69 and MSS SP89.

2. Hangers for Pipe Sizes 1-1/2 inches and Larger: Carbon steel, adjustable, clevis.

3. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

4. Vertical Support: Steel riser clamp.

5. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

6. Copper Pipe Support: Copper-plated, carbon-steel adjustable, ring.

E. Plumbing Piping - Water:

1. Conform to ASME B31.9, ASTM F708, MSS SP58, MSS SP69 and MSS SP89.

2. Hangers for Pipe Sizes 1/2 to 4 inches: Carbon steel, adjustable, clevis.

3. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

4. Vertical Support: Copper-plated, Steel riser clamp.

5. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

6. Floor Support for Hot Pipe Sizes 4 inches and Smaller: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

7. Copper Pipe Support: Copper-plated, Carbon-steel ring.

2.2 ACCESSORIES

A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

2.3 INSERTS

A. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.4 FLASHING

A. Metal Flashing: 26 gage thick galvanized steel.

B. Metal Counterflashing: 22 gage thick galvanized steel.

C. Lead Flashing:

1. Waterproofing: 5 lb./sq. ft sheet lead.

2. Soundproofing: 1 lb./sq. ft sheet lead.

D. Flexible Flashing: 47 mils thick sheet butyl; compatible with roofing.

E. Caps: Steel, 22 gage minimum; 16 gage at fire resistant elements.

2.5 SLEEVES

A. Sleeves for Pipes Through Non-fire Rated Floors: 18 gage thick galvanized steel.

B. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.

C. Sealant: Acrylic; refer to Section 07 90 00.

2.6 MECHANICAL SLEEVE SEALS

A. Manufacturers:

1. Thunderline Link-Seal, Inc.

2. NMP Corporation.

B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.7 FORMED STEEL CHANNEL

A. Manufacturers:

1. B-Line Systems.

2. Unistrut Corp.

B. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

2.8 FIRESTOPPING

A. Manufacturers:

1. Dow Corning Corp.
2. Fire Trak Corp.
3. Hilti Corp.
4. International Protective Coating Corp.
5. 3M fire Protection Products.
6. Specified Technology, Inc.

B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.

1. Silicone Firestopping Elastomeric Firestopping: Single component silicone elastomeric compound and compatible silicone sealant.
2. Foam Firestopping Compounds: Single component foam compound.
3. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.
4. Fiber Stuffing and Sealant Firestopping: Composite of mineral fiber stuffing insulation with silicone elastomer for smoke stopping.
5. Mechanical Firestopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.
6. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.
7. Firestop Pillows: Formed mineral fiber pillows.

C. Color: As selected from manufacturer’s full range of colors.

2.9 FIRESTOPPING ACCESSORIES

A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.

B. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

C. General:

1. Furnish UL listed products or products tested by other approved independent testing laboratory.
2. Select products with rating not less than rating of wall or floor being penetrated.

D. Non-Rated Surfaces:

1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where piping is exposed.

2. For exterior wall openings below grade, furnish mechanical sealing device to continuously fill annular space between piping and cored opening or water-stop type wall sleeve.

PART 3 EXECUTION

3.1 EXAMINATION

A. Division 01 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify openings are ready to receive sleeves.

C. Verify openings are ready to receive firestopping.

3.2 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.

B. Remove incompatible materials affecting bond.

C. Install backing or damming materials to arrest liquid material leakage.

D. Obtain permission from Architect/Engineer before using powder-actuated anchors.

E. Obtain permission from Architect/Engineer before drilling or cutting structural members.

3.3 INSTALLATION - INSERTS

A. Install inserts for placement in concrete forms.

B. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches and larger.

D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

3.4 INSTALLATION - PIPE HANGERS AND SUPPORTS

A. Install in accordance with ASME B31.1, ASME B31.5, ASME 31.9, ASTM F708, MSS SP 58, MSS SP 69, MSS SP 89.

B. Where insulated horizontal piping occurs, provide hanger of adequate size to allow for pipe insulation to be run continuously through the hanger assembly.

C. Support vertical piping and tubing at base and at each floor.

D. Support horizontal piping as scheduled.

E. Install hangers with minimum 1/2-inch space between finished covering and adjacent work.

F. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.

G. Maximum spans below were taken from MSS SP-69 for water service and from model plumbing codes. Most restrictive piping and spacing dimensions are shown.

H. Install hangers for CAST-IRON SOIL piping with the following maximum horizontal spacing and minimum rod diameters:

PIPE SIZE (IN.)	HORIZONTAL HANGER SPACING (FT)	ROD DIAMETER (IN.)
1½, 2	5	3/8
3	5	1/2
4, 5	5	5/8
6	5	3/4
8 - 12	5	7/8

1. Install supports for vertical cast-iron soil piping every 15 feet.

I. Install hangers for STEEL piping with the following maximum horizontal spacing and minimum rod diameters:

PIPE SIZE (IN.)	HORIZONTAL HANGER SPACING (FT)	ROD DIAMETER (IN.)
½ - 1¼	7	3/8
1½	9	3/8
2	10	3/8
3	11	1/2
4	12	5/8
6	12	3/4
8 - 12	12	7/8

1. Install supports for vertical steel piping every 15 feet.

J. Install hangers for COPPER tubing with the following maximum horizontal spacing and minimum rod diameters:

PIPE SIZE (IN.)	HORIZONTAL HANGER SPACING (FT)	ROD DIAMETER (IN.)

½ - 1¼	5	3/8
1½, 2	6	3/8
2½	8	1/2
3, 4, 5	10	1/2
6	10	5/8
8	10	3/4

1. Install supports for vertical copper tubing every 10 feet (3 m).

K. Support horizontal CPVC piping as scheduled below:

PIPE SIZE (IN.)	HORIZONTAL HANGER SPACING (FT)	ROD DIAMETER (IN.)
½ - 1	3	3/8
1¼, 2	4	3/8
2½, 3	4	1/2
4, 5	4	5/8
6	4	3/4
8	4	3/4

1. Install vertical supports for CPVC piping every 5 ft for piping 1” and smaller and every 6 ft for 1¼” and larger

L. Install hangers for DWV PVC piping with the following maximum horizontal spacing and minimum rod diameters:

PIPE SIZE (IN.)	HORIZONTAL HANGER SPACING (FT)	ROD DIAMETER (IN.)
½ - 1	3	3/8
1¼, 2	4	3/8
2½, 3	4	1/2
4, 5	4	5/8
6	4	3/4
8	4	3/4

1. Install supports for vertical PVC piping every 48 inches.

M. Place hangers within 12 inches of each horizontal elbow.

N. Use hangers with 1-1/2 inch minimum vertical adjustment.

O. Support horizontal cast iron pipe adjacent to each hub.

P. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.

Q. Support piping and tubing not listed above per MSS SP-69 and manufacturer's written instructions.

R. Prime coat exposed steel hangers and supports. Refer to Division 09. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

S. Provide clearance in hangers and from structure and other equipment for installation of insulation. Refer to Section 22 07 00.

3.5 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

A. Provide housekeeping pads of concrete, minimum 3-1/2 inches thick and extending 6 inches beyond supported equipment. Refer to Section 03 30 00.

B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.

C. Construct supports of steel members. Brace and fasten with flanges bolted to structure.

3.6 INSTALLATION - FLASHING

A. Provide flexible flashing and metal counterflashing where piping penetrates weather or waterproofed walls and floors.

B. Flashing for roof penetrations shall be provided by the roofing contractor.

C. Flash floor drains in floors with topping over finished areas with lead, 10 inches clear on sides with minimum 36 x 36 inch sheet size. Fasten flashing to drain clamp device.

D. Seal floor, shower and/or mop sink drains watertight to adjacent materials.

E. Adjust storm collars tight to pipe with bolts; caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

3.7 INSTALLATION - SLEEVES

A. Exterior watertight entries: Seal with mechanical sleeve seals.

B. Set sleeves in position in forms. Provide reinforcing around sleeves.

C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

D. Extend sleeves through floors 1inch above finished floor level. Caulk sleeves.

E. Where piping penetrates floor, ceiling, or wall, close off space between pipe and adjacent work with firestopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

F. Install chrome plated steel or stainless steel escutcheons at finished surfaces.

3.8 INSTALLATION - FIRESTOPPING

A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping and other items, requiring firestopping.

B. Fire Rated Surface:

1. Seal opening at rated floor, wall, partition, ceiling, and/or roof as follows:

a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.

b. Size sleeve allowing minimum of 1 inch void between sleeve and building element.

c. Pack void with backing material.

d. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.

C. Non-Rated Surfaces:

1. Seal opening through non-fire rated wall, partition, floor, ceiling, and/or roof opening as follows:

a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.

b. Size sleeve allowing minimum of 1 inch void between sleeve and building element.

c. Install type of firestopping material recommended by manufacturer.

2. Install wall escutcheons, floor plates or ceiling plates where conduit penetrates non-fire rated surfaces in occupied spaces. Occupied spaces include rooms with finished ceilings and where penetration occurs below finished ceiling.

3. Exterior wall openings below grade: Assemble rubber links of mechanical sealing device to size of piping and tighten in place, in accordance with manufacturer's instructions.

4. Interior partitions: Seal pipe penetrations at computer rooms, telecommunication rooms, and data rooms. Apply sealant to both sides of penetration to completely fill annular space between sleeve and conduit.

3.9 FIELD QUALITY CONTROL

A. Division 01 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect installed firestopping for compliance with specifications and submitted schedule.

3.10 CLEANING

A. Division 01 - Execution and Closeout Requirements: Requirements for cleaning.

B. Clean adjacent surfaces of firestopping materials.

3.11 PROTECTION OF FINISHED WORK

A. Division 01 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Protect adjacent surfaces from damage by material installation.

END OF SECTION 220529

Construction Documents 6/12/24

SECTION 220553

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Nameplates.
2. Tags.
3. Pipe markers.
4. Ceiling tacks.
5. Labels.

B. Related Sections:

1. Division 09 - Painting and Coating: Execution requirements for painting specified by this section.

1.2 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME A13.1 - Scheme for the Identification of Piping Systems.

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit manufacturers catalog literature for each product required.

C. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of tagged valves; include valve tag numbers.

1.5 QUALITY ASSURANCE

A. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.7 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.8 EXTRA MATERIALS

A. Division 01 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish two containers of spray-on adhesive.

PART 2 PRODUCTS

2.1 NAMEPLATES

A. Manufacturers:

1. Craftmark Identification Systems.
2. Safety Sign Co.
3. Seton Identification Products.

B. Product Description: Laminated three-layer plastic with engraved black letters on light contrasting background color.

2.2 TAGS

A. Manufacturers:

1. Craftmark Identification Systems.
2. Safety Sign Co.
3. Seton Identification Products.

B. Plastic Tags:

1. Laminated three-layer plastic with engraved letters on light contrasting background color. Tag size minimum 1-1/2 inches diameter.

C. Metal Tags:

1. Aluminum with stamped letters; tag size minimum 1½ inches diameter with finished edge.

D. Information Tags:

1. Clear plastic with printed "Danger," "Caution," or "Warning" and message; size 3-1/4 x 5-5/8 inches with grommet and self-locking nylon ties.

E. Tag Chart: Typewritten letter size list of applied tags and location in anodized aluminum frame.

2.3 PIPE MARKERS

A. Color and Lettering: Conform to ASME A13.1; "Scheme for the Identification of Piping Systems"

B. Pipe markers installed above ceiling in return air plenums shall be plenum rated.

C. Plastic Pipe Markers:

1. Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.

D. Plastic Tape Pipe Markers:

1. Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

E. Plastic Underground Pipe Markers:

1. Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mils thick, manufactured for direct burial service.

2.4 CEILING TACKS

A. Description: Steel with 3/4-inch diameter color-coded head.

B. Color code as follows:

1. Plumbing valves: Green.

2.5 LABELS

A. Description: Aluminum, size 1.9 x 0.75 inches, adhesive backed with printed identification and bar code.

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

A. Install identifying devices after completion of coverings and painting.

B. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.

C. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer. For unfinished canvas covering, apply paint primer before applying labels.

D. Install tags using corrosion resistant chain. Number tags consecutively by location.

E. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

F. Identify water heaters, pumps, tanks, and water treatment devices with plastic nameplates. Identify in-line pumps and other small devices with tags.

G. Identify control panels and major control components outside panels with plastic nameplates.

H. Identify valves in main and branch piping with tags.

I. Identify piping, concealed or exposed, with plastic pipe markers or plastic tape pipe markers. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.

J. Provide ceiling tacks to locate valves above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION 220553

SECTION 220700

PLUMBING INSULATION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plumbing piping insulation, jackets and accessories.
2. Plumbing equipment insulation, jackets and accessories.

B. Related Sections:

1. Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment.
2. Division 09 - Painting and Coating: Execution requirements for painting insulation jackets and covering specified by this section.

1.2 REFERENCES

A. ASTM International:

1. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
2. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
3. ASTM C450 - Standard Practice for Prefabrication and Field Fabrication of Thermal Insulating Fitting Covers for NPS Piping, Vessel Lagging, and Dished Head Segments.
4. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
5. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
6. ASTM C585 - Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).
7. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
8. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
9. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
10. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
11. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.

B. National Fire Protection Association:

1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

C. Underwriters Laboratories Inc.:

1. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

A. Division: Submittal procedures.

B. Product Data: Submit product description, thermal characteristics and list of materials and thickness for each service, and location.

C. Manufacturer's Installation Instructions: Submit manufacturers published literature indicating proper installation procedures.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Test pipe insulation for maximum flame spread index of 25 and maximum smoke developed index of not exceeding 50 in accordance with ASTM E84, UL 723, and NFPA 255.

B. Pipe insulation manufactured in accordance with ASTM C585 for inner and outer diameters.

C. Factory fabricated fitting covers manufactured in accordance with ASTM C450.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Applicator: Company specializing in performing Work of this section with minimum three years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Division 01: Requirements for transporting, handling, storing, and protecting products.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

C. Protect insulation from weather and construction traffic, dirt, water, chemical, and damage, by storing in original wrapping.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Division 01 - Product Requirements: Environmental conditions affecting products on site.

B. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.

C. Maintain temperature before, during, and after installation for minimum period of 24 hours.

1.8 FIELD MEASUREMENTS

A. Verify all field measurements prior to fabrication.

1.9 WARRANTY

A. Division 01: Product warranties and product bonds.

B. Furnish one year minimum.

C. Furnish five-year manufacturer warranty for man made fiber.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Manufacturers for Glass Fiber and Mineral Fiber Insulation Products:

1. CertainTeed.
2. Knauf.
3. Johns Manville.
4. Owens-Corning.

B. Manufacturers for Closed Cell Elastomeric Insulation Products:

1. Aeroflex. Aerocell.
2. Armacell, LLC. Armaflex.
3. Nomaco. K-flex.

2.2 PIPE INSULATION

A. TYPE P-1: ASTM C547, molded glass fiber pipe insulation.

1. Thermal Conductivity: 0.27 at 75 degrees F.
2. Operating Temperature Range: 0 to 850 degrees F.
3. Vapor Barrier Jacket: ASTM C1136, Type I, factory applied reinforced foil kraft with self-sealing adhesive joints.
4. Jacket Temperature Limit: minus 20 to 150 degrees F.

B. TYPE P-5: ASTM C534, Type I, flexible, closed cell elastomeric insulation, tubular.

1. Thermal Conductivity: 0.27 at 75 degrees F.
2. Operating Temperature Range: Range: Minus 70 to 180 degrees F.

2.3 PIPE INSULATION JACKETS

A. Vapor Retarder Jacket:

1. ASTM C921, white Kraft paper with glass fiber yarn, bonded to aluminized film.

2. Moisture vapor transmission: ASTM E96; 0.02 perm-inches.

B. PVC Plastic Pipe Jacket:

1. Product Description: ASTM D1784, one piece molded type fitting covers and sheet material, off-white color.

2. Thickness: 15 mils.

3. Connections: Pressure sensitive color matching vinyl tape.

2.4 PIPE INSULATION ACCESSORIES

A. Vapor Retarder Lap Adhesive: Compatible with insulation.

B. Covering Adhesive Mastic: Compatible with insulation.

C. Galvanized steel insulation protection shield. MSS SP-69, Type 40. Length: Based on pipe size and insulation thickness.

D. Closed Cell Elastomeric Insulation Pipe Hanger: Polyurethane insert with aluminum or stainless steel jacket single piece construction with self adhesive closure. Thickness to match pipe insulation.

E. Insulating Cement: ASTM C195; hydraulic setting on mineral wool.

F. Adhesives: Compatible with insulation.

1. Indoor Vapor Retarder Finish:

a. Cloth: Untreated; 9 oz/sq yd weight.
b. Vinyl emulsion type acrylic, compatible with insulation, white color.

2.5 EQUIPMENT INSULATION

A. TYPE E-2: ASTM C612; glass fiber, rigid board, noncombustible with factory applied kraft reinforced aluminum foil jacket.

1. Thermal Conductivity: 0.24 at 75 degrees F.

2. Operating Temperature Range: 0 to 450 degrees F.

3. Density: 3.0 pound per cubic foot.

4. Jacket Temperature Limit: minus 20 to 150 degrees F.

2.6 EQUIPMENT INSULATION JACKETS

A. PVC Plastic Equipment Jacket:

1. Product Description: ASTM D1785, sheet material, off-white color.

2. Minimum Service Temperature: -40 degrees F.

3. Maximum Service Temperature: 150 degrees F.

4. Water Vapor Permeance: ASTM E96/E96M; 0.02 perms.

5. Thickness: 30 mil.

6. Connections: Brush on welding adhesive with VOC content of 50 g/l according to CFR 59, Subpart D (EPA Method 24).

B. Aluminum Equipment Jacket:

1. ASTM B209.

2. Thickness: 0.020 inch thick sheet.

3. Finish: Embossed.

4. Joining: Longitudinal slip joints and 2 inch laps.

5. Fittings: 0.02 inch thick die shaped fitting covers with factory attached protective liner.

6. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum. 0.020 inch thick stainless steel.

C. Canvas Equipment Jacket: UL listed, 6 oz/sq yd, plain weave cotton fabric with fire retardant lagging adhesive compatible with insulation.

D. Vapor Retarder Jacket:

1. ASTM C921, white Kraft paper with glass fiber yarn, bonded to aluminized film.

2. Water Vapor Permeance: ASTM E96/E96M; 0.02 perms.

E. Field Applied Glass Fiber Fabric Jacket System:

1. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

2. Glass Fiber Fabric:

a. Cloth: Untreated; 9 oz/sq yd weight.
b. Blanket: 1.0 lb/cu ft density.

3. Indoor Vapor Retarder Finish:

a. Cloth: Untreated; 9 oz/sq yd weight.
b. Vinyl emulsion type acrylic, compatible with insulation, black white color.

2.7 EQUIPMENT INSULATION ACCESSORIES

A. Vapor Retarder Lap Adhesive: Compatible with insulation.

B. Covering Adhesive Mastic: Compatible with insulation.

C. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

D. Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement: ASTM C449/C449M.

E. Adhesives: Compatible with insulation.

2.8 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Calcium Silicate Adhesive: Fibrous, sodium-silicate-based adhesive with a service temperature range of 50 to 800 deg F.

1. Manufacturers:

a. Childers Products, Division of ITW; CP-97.
b. Foster Products Corporation, H. B. Fuller Company; 81-27/81-93.
c. Marathon Industries, Inc.; 290.

2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated per 40 CFR 59, Subpart D (EPA Method 24).

C. Cellular-Glass, Phenolic, Polyisocyanurate, and Polystyrene Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F.

1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Products, Division of ITW; CP-96.
b. Foster Products Corporation, H. B. Fuller Company; 81-33.

2. calculated per 40 CFR 59, Subpart D (EPA Method 24).

D. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Manufacturers:

a. Aeroflex USA Inc.; Aeroseal.
b. Armacell LCC; 520 Adhesive.
c. Foster Products Corporation, H. B. Fuller Company; 85-75.

2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated per 40 CFR 59, Subpart D (EPA Method 24).

E. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Manufacturers:

a. Childers Products, Division of ITW; CP-82.
b. Foster Products Corporation, H. B. Fuller Company; 85-20.
c. Marathon Industries, Inc.; 225.

2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated per 40 CFR 59, Subpart D (EPA Method 24).

F. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Manufacturers:

a. Childers Products, Division of ITW; CP-82.
b. Foster Products Corporation, H. B. Fuller Company; 85-20.
c. Marathon Industries, Inc.; 225.

2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated per 40 CFR 59, Subpart D (EPA Method 24).

G. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Manufacturers:

a. Dow Chemical Company (The); 739, Dow Silicone.
b. Johns-Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
c. Speedline Corporation; Speedline Vinyl Adhesive.

2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated per 40 CFR 59, Subpart D (EPA Method 24).

2.9 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content that meets the requirement of the South Coast Air Quality Management District Rule #1168. VOC limits to be per amendment date 1/7/05.

B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

1. Manufacturers:

a. Childers Products, Division of ITW; CP-35.
b. Foster Products Corporation, H. B. Fuller Company; 30-90.
c. Marathon Industries, Inc.; 590.

2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.

3. Service Temperature Range: Minus 20 to plus 180 deg F.

4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.

5. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.

1. Manufacturers:
   a. Childers Products, Division of ITW; CP-30.
   b. Foster Products Corporation, H. B. Fuller Company; 30-35.
   c. Marathon Industries, Inc.; 501.
2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
3. Service Temperature Range: 0 to 180 deg F.
4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
5. Color: White.

2.10 SEALANTS

A. Joint Sealants:

1. Joint Sealants for Cellular-Glass, Phenolic, and Polyisocyanurate Products - Manufacturers:
   a. Childers Products, Division of ITW; CP-76.
   b. Foster Products Corporation, H. B. Fuller Company; 30-45.
   c. Marathon Industries, Inc.; 405.
2. Joint Sealant for Polystyrene Products - Manufacturers:
   a. Childers Products, Division of ITW; CP-70.
   b. Foster Products Corporation, H. B. Fuller Company; 30-45/30-46.
   c. Marathon Industries, Inc.; 405.
3. Materials shall be compatible with insulation materials, jackets, and substrates.
4. Permanently flexible, elastomeric sealant.
5. Service Temperature Range: Minus 100 to plus 300 deg F.
6. Color: White or gray.
7. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated per 40 CFR 59, Subpart D (EPA Method 24).

B. FSK and Metal Jacket Flashing Sealants:

1. Manufacturers:
   a. Childers Products, Division of ITW; CP-76-8.
   b. Foster Products Corporation, H. B. Fuller Company; 95-44.
   c. Marathon Industries, Inc.; 405.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.

4. Service Temperature Range: Minus 40 to plus 250 deg F.

5. Color: Aluminum.

6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated per 40 CFR 59, Subpart D (EPA Method 24).

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Manufacturers:

a. Childers Products, Division of ITW; CP-76.

2. Materials shall be compatible with insulation materials, jackets, and substrates.

3. Fire- and water-resistant, flexible, elastomeric sealant.

4. Service Temperature Range: Minus 40 to plus 250 deg F.

5. Color: White.

6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated per 40 CFR 59, Subpart D (EPA Method 24).

2.11 FIELD APPLIED FABRIC – REINFORCING MASH

A. Woven Glass-Fiber Fabric for Pipe Insulation: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. inch for covering pipe and pipe fittings.

1. Manufacturers:

a. Vimasco Corporation; Elastafab 894.

B. Woven Glass-Fiber Fabric for Equipment Insulation: Approximately 6 oz./sq. yd. with a thread count of 5 strands by 5 strands/sq. inch for covering equipment.

1. Manufacturers:

a. Childers Products, Division of ITW; Chil-Glas No. 5.

C. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. inch, in a Leno weave, for equipment and pipe.

1. Manufacturers:

a. Foster Products Corporation, H. B. Fuller Company; Mast-A-Fab.
b. Vimasco Corporation; Elastafab 894.

2.12 FIELD-APPLIED CLOTHS

A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd.

1. Manufacturers:

a. Alpha Associates, Inc.; Alpha-Maritex 84215 and 84217/9485RW, Luben 59.

2.13 SECUREMENTS

A. Bands:

1. Manufacturers:

a. Childers Products; Bands.
b. PABCO Metals Corporation; Bands.
c. RPR Products, Inc.; Bands.

2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 3/4 inch wide with closed seal.

3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with closed seal.

4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

5. Copper clad annealed steel wire having a minimum 16-gauge thickness.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated.

a. Manufacturers:

1) AGM Industries, Inc.; CWP-1.
2) GEMCO; CD.
3) Midwest Fasteners, Inc.; CD.

2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.

a. Manufacturers:

1) AGM Industries, Inc.; CWP-1.
2) GEMCO; Cupped Head Weld Pin.
3) Midwest Fasteners, Inc.; Cupped Head.

3. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, stainless-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

a. Manufacturers:

1) AGM Industries, Inc.; RC-150.

2) GEMCO; R-150.
3) Midwest Fasteners, Inc.; WA-150.

b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

4. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

a. Manufacturers:

1) GEMCO.
2) Midwest Fasteners, Inc.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

D. Wire: 0.080-inch nickel-copper alloy.

1. Manufacturers:

a. C & F Wire.
b. Childers Products.
c. PABCO Metals Corporation.

2.14 CORNER ANGLES

A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC per ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

PART 3 EXECUTION

3.1 EXAMINATION

A. Division 01: Coordination and project conditions.

B. Verify piping and or equipment has been tested before applying insulation materials.

C. Verify surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION - PIPING SYSTEMS

A. Piping Exposed to View in Finished Spaces: Locate insulation and cover seams in least visible locations.

B. Install insulation continuously through all hanger assemblies.

C. Continue insulation through penetrations of building assemblies or portions of assemblies having fire resistance rating of one hour or less. Provide intumescent firestopping when continuing insulation through assembly. Finish at supports, protrusions, and interruptions. **Refer to Division 07 for penetrations of assemblies with fire resistance rating greater than one hour.**

D. Piping Systems Conveying Fluids Below Ambient Temperature:

1. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.

2. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.

3. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor retarder adhesive or PVC fitting covers.

E. Glass Fiber Board Insulation

1. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
2. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retarder cement.
3. Cover wire mesh or bands with cement to a thickness to remove surface irregularities.

F. Hot Piping Systems less than 140 degrees F:

1. Furnish factory-applied or field-applied standard jackets. Secure with outward clinch expanding staples or pressure sensitive adhesive system on standard factory-applied jacket and butt strips or both.

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.

3. Do not insulate unions and flanges at equipment, but bevel and seal ends of insulation at such locations.

G. Inserts and Shields:

1. Piping 1-1/2 inches Diameter and Smaller: Install galvanized steel shield between pipe hanger and insulation.

2. Piping 2 inches Diameter and Larger: Install insert between support shield and piping and under finish jacket.

   a. Insert Configuration: Minimum 6 inches long, of thickness and contour matching adjoining insulation; may be factory fabricated.
   b. Insert Material: Compression resistant insulating material suitable for planned temperature range and service.

3. Piping Supported by Roller Type Pipe Hangers: Install galvanized steel shield between roller and inserts.

H. Insulation Terminating Points:

1. Branch Piping 1 inch and Smaller: Terminate hot water piping at union upstream of the control valve.
2. Condensate Piping: Insulate entire piping system and components to prevent condensation.

I. Closed Cell Elastomeric Insulation:

1. Push insulation on to piping.
2. Miter joints at elbows.
3. Seal seams and butt joints with manufacturer's recommended adhesive.
4. When application requires multiple layers, apply with joints staggered.
5. Insulate fittings and valves with insulation of like material and thickness as adjacent pipe.

J. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces: Finish with PVC jacket and fitting covers.

K. Prepare pipe insulation for finish painting. Refer to Division 09.

3.3 INSTALLATION - EQUIPMENT

A. Factory Insulated Equipment: Do not insulate.

B. Exposed Equipment: Locate insulation and cover seams in least visible locations.

C. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retarder cement.

D. Equipment Containing Fluids Below Ambient Temperature:

1. Insulate entire equipment surfaces.
2. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
3. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.
4. Finish insulation at supports, protrusions, and interruptions.

E. Equipment in Mechanical Equipment Rooms or Finished Spaces: Finish with canvas jacket sized for finish painting.

F. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation for easy removal and replacement without damage.

G. Prepare equipment insulation for finish painting. Refer to Division 09.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.

4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
1. Comply with requirements for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:
1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies.

3.5 SCHEDULES

A. Water Supply Services Piping Insulation Schedule:

PIPING SYSTEM	INSULATION TYPE	PIPE SIZE	INSULATION THICKNESS (inches)
Domestic Hot Water Supply and Recirculation	P-1	1-1/4 inches and smaller 1-1/2 inches and larger	1.0 1.5
Domestic Cold Water	P-1 or P-5	1-1/4 inches and smaller 1-1/2 inches and larger	0.5 1.0
Domestic Hot Water Supply and Recirculation 140-160 deg. F	P-1	1-1/4 inches and smaller 1-1/2 inches and larger	1.0 1.5

B. Drainage Services Piping Insulation Schedule:

PIPING SYSTEM	INSULATION TYPE	PIPE SIZE	INSULATION THICKNESS (inches)
Storm Piping (horizontal above ground within building)	P-1 or P-5	All sizes	1.0

C. Equipment Insulation Schedule:

EQUIPMENT	INSULATION TYPE	INSULATION THICKNESS (inches)
Roof Drain Bodies	E-2	1.0

END OF SECTION 220700

Construction Documents 6/12/24

SECTION 223010
PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 (General Requirements) sections of the Project Manual apply to this Section.

B. The General Conditions shall be carefully examined before proposals for any work are submitted. Division 22 shall not be interpreted as waiving or overruling any requirements expressed in the General Conditions unless Division 22 sections contain statements more definitive or more restrictive.

1.2 SUMMARY

A. This Section includes the following:

1. Water Heaters
2. Pumps
3. Expansion Tanks

B. Related Sections include the following:

1. Section 22 05 03 – Plumbing Pipe, Tube and Fittings
2. Section 22 05 23 – General-Duty Valves for Plumbing Piping
3. Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment
4. Section 22 07 00 – Plumbing Insulation
5. Section 22 42 00 – Plumbing Fixtures

1.3 SUBMITTALS

A. Submittals shall be in accordance with Section 220500 – Plumbing General.

B. The Contractor shall submit manufacturer's catalog data for the following:

1. Water Heaters
2. Pumps
3. Expansion Tanks

C. The Contractor shall submit Operation and Maintenance Data in accordance with Section 220500 for the following:

1. Water Heaters
2. Pumps

PART 2 - PRODUCTS

2.1 WATER HEATERS

A. General

1. Packaged water heater systems shall be furnished factory wired and UL listed. Final electrical connections shall be provided as indicated in Division 26.

2. Storage tanks shall be insulated so that the maximum heat loss of the tank does not exceed 14 BTUH per square foot of tank surface area or the current ASHRAE 90 standard, whichever is more stringent.

3. Water heater systems shall meet current ASHRAE 90A efficiency requirements.

4. Packaged water heater located in food preparation or food storage areas shall be National Sanitation Foundation certified and bear the NSF label.

5. Provide the services of a manufacturer's representative experienced in the installation and operation of this equipment for not less than one workday on-site for installation inspection, startup, and instruction of owner's personnel.

B. Gas Fired Storage Water Heater

1. The water heater shall have a modulating input rating and recovery capacity as indicated on the drawings and shall be operated on Natural Gas. The water heater shall be capable of full modulation firing down to 20% of rated input with a turn down ratio of 5:1.

2. The water heater shall consist of a direct fired stainless steel heat exchanger mounted on top of a glass lined storage tank in a fashion that will reduce the amount of scale build-up that is known to reduce efficiency. The water heater shall have no visible pipes that connect the heat exchanger to the storage tank. Heat exchangers with input in excess of 200,000 Btu/Hr shall bear the ASME "HLW" stamp and shall be National Board listed. There shall be no banding material, bolts, gaskets or "O" rings in the header configuration. The stainless steel combustion chamber shall be designed to drain condensation to the bottom of the heat exchanger assembly. A built-in trap shall allow condensation to drain from the heat exchanger assembly. The water heater shall carry a three (3) year warranty against leaks (one (1) year parts).

3. The water heater shall bear the ASME "HLW" stamp and shall be National Board listed. The tank shall have a working pressure of 150 psi. The tank shall be glass lined and fired to 1600°F to ensure a molecular fusing of glass and steel. The tank shall be completely encased in high density insulation of sufficient thickness to meet the energy efficiency requirements of the latest edition of the ASHRAE 90.1 Standard. The tank shall be fitted with a brass drain valve.

4. The water heater shall be certified and listed by C.S.A. International under the latest edition of the harmonized ANSI Z21.10.3 test standard for the US and Canada. The water heater shall comply with the energy efficiency requirements of the latest edition of the ASHRAE 90.1 standard. The water heater shall operate at a minimum of 96% thermal efficiency. The water heater shall be certified for indoor installation. The water heater's efficiency shall be verified through third party testing by AHRI and listed in the AHRI Certification Directory.

5. The water heater shall be constructed with a heavy gauge steel jacket assembly, primed and pre-painted on both sides. The combustion chamber shall be sealed and completely enclosed, independent of the outer jacket assembly, so that integrity of the outer jacket does not affect a proper seal. A burner/flame observation port shall be provided. The burner shall be a premix design and constructed of high temperature stainless steel with a woven metal fiber outer covering to provide

modulating firing rates. The water heater shall be supplied with a gas valve designed with negative pressure regulation and be equipped with a variable speed blower system, to precisely control the fuel/air mixture to provide modulating water heater firing rates for maximum efficiency. The water heater shall operate in a safe condition at a de-rated output with gas supply pressures as low as 4 inches of water column.

6. The water heater shall utilize a 24 VAC control circuit and components. The control system shall have an electronic display for water heater set-up, water heater status, and water heater diagnostics. All electronic circuitry shall be easily accessed and serviceable from the front of the jacket. The water heater shall be equipped with; an all-bronze circulating pump; high limit temperature control; ASME certified temperature and pressure relief valve; inlet & outlet water temperature sensors; flue temperature sensor; runtime contacts; alarm contacts; low water flow protection, contacts for louvers, security protection, adjustable pump delay, enable/disable contacts and built-in freeze protection. The manufacturer shall verify proper operation of the burner, all controls and the heat exchanger by connection to water and venting for a factory fire test prior to shipping.

7. The water heater shall feature a SMART Control with an LCD display with soft key pad, pump delay with freeze protection and pump exercise. The water heater shall be equipped with an eight foot power cord. Supply voltage shall be 120 volt / 60 hertz / single phase.

8. The water heater shall be installed and vented per manufacturer's instructions and as indicated on the drawings.

9. The water heater shall be approved for 180°F operation.

10. The water heater shall have an independent laboratory for Oxides of Nitrogen (NO_x) of 20 ppm or less, corrected to 3% O_2.

11. The water heater shall operate at altitudes up to 4,500 feet above sea level without additional parts or adjustments.

12. Approved manufacturers: Lochinvar, A.O. Smith, Bradford White.

2.2 PUMPS

A. Domestic Water Packaged Booster Pump – Mulitplex, Variable-Speed Booster Pumps

1. Description: Factory-assembled and -tested, fluid-handling system for domestic water, with pumps, piping, valves, specialties, and controls, and mounted on base.

2. Pumps:
   a. Type: Vertical, multistage as defined in HI 1.1-1.2 and HI 1.3 for in-line, multistage, separately coupled, overhung-impeller, centrifugal pump.
   b. Casing: Cast-iron or steel base and stainless steel chamber.
   c. Impeller: Closed, stainless steel; statically and dynamically balanced and keyed to shaft.
   d. Shaft: Stainless steel.
   e. Seal: Mechanical.
   f. Bearing: Water-lubricated sleeve type.

3. Motors: Single speed, with pre-greased, permanently shielded ball bearings. Select motors that will not overload through full range of pump performance curve.

4. Piping: Stainless-steel pipe and fittings

5. Valves:
   a. Shutoff Valves NPS 2-1/2 and Larger: Lug-type butterfly valve in each pump's suction and discharge piping.
   b. Check Valves NPS 2-1/2 and Larger: Silent type in each pump's discharge piping.
   c. Thermal Relief Valve: Temperature-and-pressure relief type in pump's discharge header piping.

6. Dielectric Fittings: With insulating materials to isolate joined dissimilar metals.

7. VFC: Comply with Section 26923 "Variable-Frequency Motor Controllers"

8. Base: Structural Steel.

9. Capacities and Characteristics: As indicated on plumbing drawings.

10. Booster pumps shall be listed and labeled as packaged pumping systems by testing agency acceptable to authorities having jurisdiction.

11. Approved Manufacturers: Hyfab, Bell & Gossett, Grundfos, Taco

B. Hot Water Recirculation Pumps shall have capacities and motor HP as noted on the drawings. Pump shall be of all bronze construction and shall be furnished with companion flanges. Pump assembly shall be provided with isolation valves, check valve, two test plugs for insertion of pressure gauges and temperature sensor. Temperature sensor shall be connected to Building Automation System (BAS). BAS system shall cycle pump on and off as indicated on the mechanical drawings.

   1. Approved Manufacturers: Bell & Gossett, Taco, Grundfos

C. Elevator Pit Sump Pump.

   1. A submersible sump pump shall have a capacity as indicated on the drawings. Motor shall be hermetically sealed, capacitor start type with built-in overload protection and Class B insulation.

   2. The pump shall be furnished with a compression type micro-pressure switch, bracket mounted on the pump and discharge pipe. The switch shall be suitable for either 110 volt or 230 volt, single phase operation and shall be furnished with ten (10) feet of PVC cord and a "piggyback" combination grounded plug and receptacle.

   3. Bearings shall be factory sealed, grease lubricated, ball bearing type. Pump shall be Type 303 stainless steel and shall utilize a mechanical seal arrangement. Pump impeller shall be of phenolic construction and pump shall be furnished with a perforated steel plate strainer.

4. Provide control panel with remote audible and visual alarms.

5. Approved Manufacturers: Little Giant, Weil, Oil Minder

2.3 EXPANSION TANK

A. Pre-pressurized diaphragm type steel expansion tank. Tank shall conform to ASME Section VIII construction for 125 psig, (200 psig WOG), tank shall have rigid polypropylene lining for corrosion control, butyl rubber diaphragm. Provide pressure gauge on system connection piping.

B. Thermal expansion tank shall be installed to absorb expansion from hot water generator and storage tanks under no-flow or low-flow conditions. System connection shall not be located upstream of check valves or regulating valves or downstream of mixing valves or in a manner that shall negate this purpose.

C. Thermal expansion tank pressurization shall be field charged to match the domestic water system pressure when pumps are energized and when water temperature in storage tank is at 40 to 80°F temperature. Acceptance volume shall be based upon the difference between system pressure and temperature relief valve pressure.

D. Approved Manufacturers: Amtrol, Bell & Gossett, Wessels

PART 3 - EXECUTION

3.1 INSTALLATION

A. All equipment, piping and accessories shall be installed in strict accordance with manufacturer's requirements.

B. Water heaters exceeding heat input capacity of 200,000 BTUH (58.6 KW) or nominal water capacity of 120 gallons fall are under the jurisdiction of the North Carolina Department of Labor in accordance with General Statute Chapter 95, Article 7A, Section 95-69 10. The Contractor shall obtain NC DOL inspection and approval for water heaters meeting one of the criteria listed above.

C. Water heaters which are not provided with recirculating piping system shall be provided with heat trap type of piping arrangement on the hot water outlet of the water heater.

D. Drain and thermal purge from all pumps shall be extended to within 4 inches of floor drain.

E. Water heater relief valves shall be piped as indicated or to a point which will not cause personal injury or property damage and shall be readily observable by the building occupants.

F. Water heaters or storage tanks located in areas where leakage of the tanks or connection will cause damage shall be provided with galvanized steel pan.

G. Provide isolation valves for all equipment and accessories.

H. Unions shall be provided adjacent to all equipment or wherever necessary to facilitate the removal of equipment for repair or replacement. Unions for copper tubing up to and including 2 inch diameter shall be brass ground joint with socket ends for solder. Unions

for copper tubing 2-1/2 inches in diameter and over shall be standard brass flanges and so stamped. No lip type unions or long screws will be permitted. The contractor shall furnish and install all structural steel angles, channels, etc. necessary to properly support all fixtures and equipment to the satisfaction of the Professional.

I. Furnish and install isolation valves at the cold water and hot water supply tappings and an AGA/ASME pressure and temperature relief valve for each water heater.

J. The drawings are diagrammatic in showing plumbing equipment layout. Variations in differing manufacturer's piping arrangements and physical equipment size require careful layout by the Contractor. The Contractor shall coordinate his layout so as to provide adequate clearances to allow for maintenance and inspection. In particular, equipment supports shall not obstruct floor drains or utility trench access and piping shall be installed to allow sufficient vertical clearance above treatment tanks.

END OF SECTION 223010

SECTION 224200
PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 (General Requirements) sections of the Project Manual apply to this Section.

B. The General Conditions shall be carefully examined before proposals for any work are submitted. Division 22 shall not be interpreted as waiving or overruling any requirements expressed in the General Conditions unless Division 22 sections contain statements more definitive or more restrictive.

1.2 SUMMARY

A. This Section includes the following:

1. Water Closets
2. Urinals
3. Lavatories
4. Sinks
5. Electric Water Coolers
6. Showers
7. Emergency Equipment

B. Related Sections include the following:

1. Section 22 05 03 – Plumbing Pipe, Tube and Fittings
2. Section 22 05 23 – General-Duty Valves for Plumbing Piping
3. Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment
4. Section 22 07 00 – Plumbing Insulation

1.3 SUBMITTALS

A. Submittals shall be in accordance with Section 220500 – Plumbing General.

B. The Contractor shall submit manufacturer's catalog data for the following:

1. Water Closets
2. Urinals
3. Lavatories
4. Sinks
5. Electric Water Coolers
6. Showers
7. Flush Valves
8. Toilet Seats
9. Fixture Carriers
10. Faucets and Mixing Valves
11. Emergency Equipment

C. The Contractor shall submit Operation and Maintenance Data in accordance with Section 220500 for the following:

1. Electric Water Coolers
2. Flush Valves
3. Faucets and Mixing Valves
4. Emergency Equipment

PART 2 - PRODUCTS

2.1 GENERAL

A. All fixtures shall be furnished complete with traps, faucets, wastes, supplies with stops, etc., as required. All exposed metal parts shall be chromium plated.

B. Fixtures and equipment shall be those of reputable manufacturers and shall be new and the best of their respective kinds.

C. All fixtures and equipment of similar types shall be of the same manufacturer unless indicated otherwise on the drawings or specified herein.

D. Fixtures shall be mounted at mounting heights as indicated.

E. If fixtures and equipment indicated in the Contract Documents are not currently manufactured, the manufacturer's current equivalent to the indicated fixtures and equipment shall be provided at no additional cost, subject to review and acceptance by the Professional.

2.2 PLUMBING FIXTURES

A. See Plumbing Fixture Schedule on Drawings for Fixture Specification. Manufacturers shall be equal to those listed on the drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fixtures and equipment shall be installed in a neat and workmanlike manner and in accordance with the manufacturer's recommendations. The quality of installation shall be subject to the approval of the Professional.

B. All wall mounted lavatories, chair carriers and supports shall be suitable to the type of construction wherein they are located. Urinals and water closets shall be supported by chair carriers.

C. All fixtures and equipment must be protected against damage during the progress of construction. Upon completion of construction, all fixtures and equipment must be thoroughly cleaned and left in perfect working order. All piping and accessories having polished, plated or finished surfaces shall be protected to prevent scarring or other damage and protect the finish against damage.

D. Provide isolation valves for all fixtures, equipment, and accessories.

E. All fixture supplies and waste lines shall be run to wall unless construction requires they be run to floor. All supplies through walls shall be provided with angle stops. All supplies through floors shall be provided with straight stops. Unions shall be provided

adjacent to all equipment or wherever necessary to facilitate the removal of equipment for repair or replacement. Unions for copper tubing up to and including 2 inch diameter shall be brass ground joint with socket ends for solder. Unions for copper tubing 2-1/2 inches in diameter and over shall be standard brass flanges and so stamped. No lip type unions or long screws will be permitted. The contractor shall furnish and install all structural steel angles, channels, etc. necessary to properly support all fixtures and equipment to the satisfaction of the Professional.

F. Drain piping from all backflow preventers, relief valves and vents, drain down connections, kitchen equipment, etc. shall be extended to within 4 inches of a floor sink or floor drain unless otherwise directed.

G. Shower outlets and mop receptor drains shall be sized for the outlet pipe size shown on drawings and shall be equipped with P-traps. The Contractor shall be responsible for proper height setting and leveling of drains.

H. Apply a bead of waterproof caulking around the edge of surface mounted plumbing fixture to mask any irregularities between the fixture and wall finish. Color of caulk shall match the fixture color.

3.2 MOUNTING HEIGHTS

A. Plumbing fixture mounting heights shall be as indicated on the drawings. Mounting heights for barrier free fixtures shall meet the requirements of the ADA Accessibility guidelines. These guidelines shall apply unless superseded by more stringent State or Local requirements.

END OF SECTION 224200

Construction Documents 6/12/24

SECTION 230500

COMMON WORK RESULTS FOR HVAC

PART 1: GENERAL

1.1 RELATED PROVISIONS

a. The requirements of the general conditions and of Division 01 apply to that portion of the work specified in this section.

b. These specifications and the accompanying drawings shall include the furnishing of all labor, tools, materials, fixtures, transportation, appurtenances and service necessary and incidental to the installation of a complete and operative system as indicated and intended on the Drawings and as herein specified.

c. Contractor shall coordinate the work and equipment of this division with the work and equipment specified elsewhere in order to assure a complete and satisfactory installation. Work such as excavation, backfill, concrete, flashing, etc., which is required by the work of this Division of the Specifications, shall be provided by this Division unless otherwise indicated.

d. Minor details not usually shown or specified, but necessary for the proper installation and operation, shall be included in the work, the same as if herein specified or shown.

1.2 DESCRIPTION OF THE WORK:

a. Work included under this Division includes installation of a new cooling and heating system and associated electrical system and controls system. The systems shall be installed complete, with boilers, piping, chiller, pumps and auxiliaries as hereinafter called for. Miscellaneous items including conduits, concrete slab, etc., are to be provided as indicated.

b. It shall be the responsibility of the Contractor to provide a complete and operating system according to the true intent and meaning of the plans and specifications and all pipe, controls and equipment, etc.

1.3 DEFINITION

a. The word "Contractor" as used in this Section of the Specifications refers to the HVAC Contractor unless specifically noted otherwise. The word "provide" means furnish, fabricate, complete, install, erect, including labor and incidental materials, necessary to complete in place and ready for operation or use the items referred to or described herein, and/or as shown or referred to on the Contract Drawings.

1.4 HVAC CONTRACTOR'S QUALIFICATIONS

a. It is assumed that the contractor has had sufficient general knowledge and experience to anticipate the needs for a construction of this nature. The contractor shall furnish all items required to complete the construction in accordance with reasonable interpretation of the intent of the Drawings and Specifications. Any minor items required by Code, law or regulations shall be provided whether or not specified or specifically shown.

b. All work must be done by first class and experienced mechanics properly supervised, and it is understood that the Engineer has the right to stop any work that is not being properly done and has the right to demand that any incompetent workman be removed from the job and a competent workman be substituted therefor.

c. All work must be done in strict accordance with standards of AME, ASHRAE and the building laws of all character in force in the locality where the apparatus is being installed. All work must also be in accordance with rules and regulations of the National Board of Fire Underwriters.

1.5 DUTIES OF CONTRACTOR

a. Contractor is responsible for familiarizing himself with the details of the construction of the building. Work under these specifications installed improperly or which requires changing due to improper reading or interpretation of building plans shall be corrected and changed as directed by Engineer without additional cost to the Owner.

b. Contractor shall leave the premises in a clean and orderly manner upon completion of work, and shall remove from premises all debris that has accumulated during the progress of the work. The HVAC Contractor shall have the permanent HVAC systems in sufficient readiness for furnishing temporary climatic control at the time the building is enclosed. The HVAC systems control shall maintain climatic control throughout the enclosed portion of the building sufficient to allow completion of the interior finishers of the building. A building shall be considered enclosed when it has windows installed and when doorways and other openings have protection which will provide reasonable climatic control. The appropriate climatic condition shall be jointly determined by the Contractor and the Architect. Use of the equipment in this manner shall in no way affect the warranty requirements of the Contractor.

1.6 CODES, RULES, PERMITS AND FEES

a. The contractor shall give all necessary notices, obtain all permits and pay all government sales taxes, fees and other costs including utility connections or extension, in connection with his work; file all necessary plans, prepare all documents and obtain all necessary approvals of all governmental departments having jurisdiction; obtain all required certificates for inspection for his work and deliver same to the Architect before request for acceptance and final payment for the work.

b. The contractor shall include in the work, without extra cost to the Owner, any labor, materials, services, apparatus, ordinances, rules and regulations as required to complete the project in accordance with the intent of the drawings.

c. All materials furnished and all work installed shall comply with the National Fire Codes of the National Fire Protection Association, with the requirements of all governmental departments having jurisdiction.

1.7 SURVEYS AND MEASUREMENTS

a. The contractor shall base all measurements, both horizontal and vertical, from established bench marks. All work shall agree with these established lines and levels. Verify all measurements at the site and check correctness of same as related to the work.

b. Should the contractor discover any discrepancy between actual measurements and those indicated, which prevents following good practice or the intent of the drawings and Specifications, he shall notify the Architect and shall not proceed with his work until he has received instructions from the Architect.

1.8 PLANS

a. Except where dimensions are shown, mechanical plans are diagrammatic; see Architectural drawings for building dimensions and locations of windows, doors, ceiling diffusers, lights, etc. The plans are not intended to show each and every fitting, valve, pipe or pipe hanger, or a complete detail of all the work to be done, but are for the purpose of illustrating the type of system, pipe and duct sizes, etc. and special conditions considered necessary for the experienced mechanic to take off his material and lay out his work. Contractor shall be responsible for taking such measurements as may be necessary at the job, and adapting his work to the local conditions.

1.9 DRAWINGS AND SPECIFICATIONS

a. Plans are diagrammatic, and it sometimes occurs that conditions exist in buildings which require certain changes in drawings and specifications. In event that such changes are necessary, the same are to be made by Contractor without expense to the Owner, provided however, that such changes, do not require furnishing more material or performing more labor than the true intent of the drawings and specifications demand.

b. It is understood that while the drawings are to be followed as closely as circumstances will permit, the Contractor is held responsible for the installation of the system according to the true intent and meaning of the drawings. Anything not entirely clear on the drawings or in the specifications will be fully explained if application is made to the Engineer. Should however, conditions arise where in the judgment of the Contractor certain changes would be advisable. Contractor will communicate with Engineer and secure approval of the changes before going ahead with the work.

c. The electrical and mechanical systems for this job have been designed on the basis of the mechanical equipment listed or data given herein or on the drawings. It shall be the responsibility of the Contractor to determine that the electrical service outlets, wiring, conduit and all overcurrent protective and safety devices furnished are

adequate to meet Code Requirements for the equipment which he proposes to use. Changes required in the electrical system to accommodate the proposed mechanical equipment shall be worked out and the details submitted for approval. The cost of making the necessary changes to the electrical system shall be the responsibility of the Contractor.

1.10 SHOP DRAWINGS

a. Refer to Division 01.

b. All items submitted to Architect for review shall bear stamp or notation indicating contractor's prior review and approval.

c. Any Electrical or other changes required by substituted equipment to be made at no change in contract price.

d. Submit manufacturer's certified performance data for all equipment.

e. Coordinate installation drawings with other parts of the work, whether specified in this Division or other Divisions.

f. Approval of shop drawings by the Engineer shall not relieve the Contractor from his obligation to provide equipment, control, and operation to the true intent of plans and specifications.

g. The Contractor shall submit to the Engineer, within ten (10) days after approval of bids by the owner, a list indicating the manufacturer of all equipment and materials which he proposes to use. After that date, no substitution will be approved and all items shall be as specified.

1.11 COORDINATION DRAWINGS

a. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

2. Roof framing and support members relative to duct penetrations.
3. Ceiling suspension assembly members.
4. Size and location of initial access modules for acoustical tile.
5. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

1.12 SCAFFOLDING, RIGGING, HOISTING:

a. This contractor shall furnish all scaffolding rigging, hoisting, and services necessary to erection and delivery into the premises of any equipment and apparatus furnished. Remove same from premises when no longer required.

1.13 FOUNDATIONS, SUPPORTS, PIERS, ATTACHMENTS:

a. Contractor shall furnish and install all necessary foundations, supports, pads, bases and piers required for all air conditioning equipment, piping, pumps, tanks, compressors, and for all other equipment furnished under this contract.

1.14 SLEEVES AND OPENINGS:

a. Contractor must have an experienced mechanic on the job before concrete slab floors or concrete masonry walls are poured or built into place, whose duty it shall be to locate exact positions of any and all holes necessary for future installation of his pipe work, ducts or equipment. Where pipes pass through concrete or masonry walls or floors, steel pipe sleeves shall be furnished. These shall be the same length as wall thickness and shall extend 1/2" above finished floors. Pipe sleeves in equipment room floors shall extend 3" above refinished floor. Pipe sleeves in equipment room floors shall extend 3" above finished floor. Sleeves shall be placed in position by this Contractor.

b. This Contractor shall arrange for proper openings in the building to admit his equipment. If it becomes necessary to cut any portion of building to admit his equipment, portions cut must be restored to their former condition by this Contractor.

c. This Contractor will provide duct openings or chases in masonry or concrete; however, it is this Contractor's responsibility to advise exact dimensions, shape and locations of openings required in sufficient time for the Contractor to make necessary provisions. This Contractor shall be responsible for correct size and location of each opening for his equipment through these openings.

d. Wall openings that require a fire or smoke damper shall be made as nearly possible to the damper or duct size so that an angle frame can close the opening entirely.

e. Where pipes or ducts penetrate floors or partitions which are fire or smoke barriers, the integrity of the barrier shall not be compromised by such penetration.

1.15 CUTTING AND PATCHING:

a. The Contractor shall do all cutting, fitting and patching as required to install piping and equipment except openings through the roof shall be provided by the General Contractor. Patching shall be done by mechanics skilled in the various trades and work shall match the existing work.

b. All exposed openings in walls and floors for piping shall be core drilled. Cutting of holes by hand will not be allowed.

c. Provide all required protection including but not limited to, welding blankets, dust covers, shoring bracing and supports to maintaining structural integrity, safety and cleanliness of the work.

1.16 EXCAVATION AND BACKFILLING:

a. All excavation and backfilling, pudding and tamping required to properly install work under this contract shall be done by this Contractor.

b. Trenches shall be on an even grade and firmly packed to form a solid foundation for laying piping. The Contractor is cautioned to comply with the North Carolina Department of Labor requirements concerning shoring for excavations.

c. Backfill shall be clear of rocks and trash. Backfilling shall be water tamped so as to provide firm footing for finish work, and shall be maintained at proper level for duration of the Contract. No backfilling shall be done until work to be covered has been inspected. Excessive excavation material shall be deposited on site and leveled as directed by the engineer.

1.17 POURED IN PLACE CONCRETE WORK:

a. Furnish and install all concrete work required for the construction of anchors, guide bases and elsewhere as indicated on the Drawings. Refer to appropriate Section in Division 3 for specification requirements.

1.18 STORAGE OF MATERIALS:

a. Equipment, ductwork, piping, and other equipment stored on site shall be protected from mud, dust, debris, weather, vermin, and construction traffic.
b. Equipment, ductwork, piping, and other equipment shall be capped or otherwise covered to prevent water, dust, and debris intrusion. Cellophane membrane may be used for duct and equipment with care taken to maintain the seal integrity. Covering shall be replaced if seal is disturbed. Covering shall be removed only when necessary.
c. Where pipe or ductwork becomes damaged by rust, dirt, dust, mud, or construction debris, it must be thoroughly cleaned and prepared to a like-new condition before installation.
d. Porous materials such as duct liner and insulation that become saturated with water shall be discarded and replaced.
e. Any equipment and/or materials affected (including aesthetically) as a result of improper storage shall be cleaned or replaced at contractor expense.

PART 2: PRODUCTS

2.1 MATERIALS

a. Provide equipment complete with all components and accessories necessary to its satisfactory operation.

b. Listing of a manufacturer's name in this Division does not infer conformity to all requirements of the Contract Documents, nor waive requirements thereof.

PART 3: EXECUTION

3.1 BELT DRIVES

a. V-belt drives shall be rated at not less than 200% of nominal motor horsepower.

b. Motor sheaves shall be fixed pitch type.

c. Scheduled fan static pressures are estimated. Provide one extra drive per device as required to allow adjustment to deliver scheduled air quantities against actual system resistance.

d. Provide guards for all belt drives not enclosed within equipment housings. Provide openings in guard at driving and driven sheaves for use of revolution counter.

3.2 MAINTENANCE AND OPERATING INSTRUCTIONS

a. Upon completion of all work, the Contractor shall furnish a complete set of operating instructions for all equipment. Such instructions shall be diagrammatic in form on heavy white paper, suitably framed, protected with glass and hung where directed by the owner. A preliminary draft of the instruction sheets shall be submitted to the engineer for approval before making same.

b. Manufacturer's instruction books, card, etc., (to each individual piece of equipment furnished under this contract) shall be furnished to the owner. These shall contain instructions for the operation and maintenance of all equipment. Where such is not furnished by the manufacturer, the contractor shall give written instructions to the owner for the maintenance of the equipment involved.

3.3 DUCTS, PLENUM, ETC.

a. As indicated on drawings, provide a system of ducts for supplying returning and exhausting air from various spaces. All details of the ductwork are not indicated and the necessary bends, offsets and transformations must be furnished whether shown or not.

b. All sheet metal ducts, casing, plenums, etc., of sizes indicated, shall be constructed from prime galvanized sheet steel, and shall be in accordance with or equal to standards set forth in latest issue of SMACNA low velocity duct manual for gauges of materials, (2" pressure), workmanship, method of fabrication and erection.

c. All uninsulated panels of ducts over twelve inches (12") wide shall be cross-broken, except on plenums, which shall be braced with angle iron as required to prevent breathing.

d. All ductwork must present a smooth interior and joints must be airtight. Where there is evidence of undue leakage at the joints in low pressure ducts, they shall be sealed with cement similar to Foster 30-02.

e. Depending upon space requirements, round or square elbows may be used as required or at the Contractors option in low velocity ducts. All elbows shall be constructed for minimum pressure drop. All elbows with an inside radius less than 3/4 the width of the duct must be fitted with multiple double thickness turning vanes.

f. No transformations or offsets shall be made with a slope greater than (7 to 1), space conditions permitting.

g. Where indicated on drawings, ductwork is to be lined with flexible fiberglass acoustics material weighing not less than 1 1/2 lb. per cubic foot and having a flame spread classification of not more than twenty-five (25) as listed under Underwriters Laboratories. Liner shall be applied according to SMACNA duct liner standard. Thickness shall be as indicated on the drawings. Duct sizes on plan are inside clear sizes, increase the actual sheet metal size accordingly in sizing the duct.

h. The lining shall be secured to the ductwork with a suitable adhesive and with mechanical fasteners center. Liner shall be cut such that adjacent sections of insulation butt together and are sealed with Foster 30-02 joints.

i. All duct connections to and from all centrifugal fans or cabinets containing fans, shall be made with fabric equal to "Ventfab" as made by Ventfabrics, Inc., not less than four inches (4") long secured by peripheral iron straps holding fabric in galvanized iron, except as otherwise noted.

j. Vertical ducts shall be supported by means of an angle iron frame riveted to the ductwork on at least two (2) sides. Horizontal runs of ductwork shall be supported on not more than 8'-0" centers as required.

k. Manual volume and splitter dampers shall be furnished and installed where shown and where necessary for proper regulation of the air distribution. A quadrant and set screw equal to "Ventlock" #641 shall be installed for all dampers which are concealed above plaster or gypsum board ceilings, or behind the masonry construction, furnish and install concealed regulators ("Ventlock" #666) with chrome cover plate.

l. All ductwork shall operate without chatter and vibration, and shall be free from pulsations.

m. See section 233113 for metal ductwork requirements.

3.4 ACCESS DOORS OR PANELS

a. Provide duct access doors of approved construction at any apparatus requiring service and inspection. Doors shall suit finish in which installed.

b. Access doors in rated walls or assemblies shall be rated as required to maintain rating of assembly. Rated access doors shall bear U.L. Label.

3.5 CLEANING DUCT SYSTEM

a. Upon complete installation of ducts, clean entire system of rubbish, plaster, dirt, etc., before installing any outlets. After installation of outlets and connections to fans are made, blow out entire systems with all control devices wide open.

3.6 ITEMS OF ELECTRICAL EQUIPMENT

a. All electrical work shall be done by properly licensed electrical mechanics in accordance with Division 26 of the specifications under supervision of a licensed Electrical Contractor as approved by the Architect.

b. The Electrical Contractor shall provide all power wiring to motor starter and/or disconnect switch and from starter/disconnect switch to motor. The Mechanical Contractor shall provide all control wiring, low voltage or line voltage, as required for the operation of all mechanical equipment. All control devices such as motor starters, thermostats, switches, etc. shall be provided by the Mechanical Contractor.

c. All motor starters shall be provided with a "hand-off-auto" switch on the starter cover.

d. All items of mechanical equipment electrically operated shall be in complete accordance with electrical division of the specifications. Mechanical equipment, other than individually mounted motors, shall be factory prewired so that it will only be necessary to bring connections to a single set of terminals.

e. Mechanical equipment electrical components shall all be bonded together and connected to electrical system ground.

f. All mechanical equipment shall be U.L. listed and labeled as a complete package, not through individual components or parts. Provide required 3rd party field UL listing services as required to comply.

3.7 WARRANTY AND SERVICE

a. Upon completion of all work, the contractor shall check the system out so that all motor bearings are greased as required and have all systems balanced. He shall be responsible for original service, of starting the system up, and providing one set of replacement filters after final acceptance.

b. Refer to equipment specifications for specific warranty information.

3.8 INSPECTION AND ACCEPTANCE TEST

a. The project will be checked periodically as construction progresses. The contractor shall be responsible for notifying the Engineer at least 48 hours in advance when any work to be covered up is ready for inspection. No work will be covered up until approved by the Engineer.

b. Upon completion of erection of all equipment and work specified herein and shown approved shop drawings, and at the time designated by the engineer, the contractor shall start all apparatus, making necessary tests as directed and as specified herein, and make adjustments of all parts of all equipment before acceptance of equipment by the owner. The contractor must demonstrate to the owner, by performance, that all equipment operates as specified and meets the guarantee called for.

c. Tests shall include satisfactory evidence that all systems operate as called for on the drawings, and that all pieces of equipment operate at specified ratings under specified operating conditions.

d. The contractor shall furnish all fuel and power required for these purposes, and provide the proper and necessary help required to operate the system while tests are being made.

e. All drainage piping shall be tested by filling with water to a point 10' above the underground drains or to point of discharge to grade and let stand thus filled for 3 hours.

f. Tests on all pipe work shall be subject to the inspection of the Engineer. He shall be given 24-hours notice when a section pipe is to be tested and the test shall not be removed until permission is given by the Engineer.

3.9 AS BUILT DRAWINGS

b. This contractor shall keep on the job at all times, a clean set of contract drawings in blueprint form. As the job progresses, any and all deviations from the arrangements, piping runs, equipment locations, etc., shown on the bid prints shall be marked on this set with red ink. These prints shall not be used for any other purpose than to be marked up as "As-Built" Drawings.

3.10 OWNER TRAINING

A. Engage a factory-authorized service representative with complete knowledge of Project-specific system installed to train Owner's maintenance personnel to adjust, operate, and maintain the equipment listed below:
1. DDC Control Systems
2. Air Handlers

B. Extent of Training:

1. Base extent of training on scope and complexity of equipment installed and training requirements indicated. Provide extent of training required to satisfy requirements indicated even if more than minimum training requirements are indicated.
2. Inform Owner of anticipated training requirements if more than minimum training requirements are indicated.
3. Minimum Training Requirements:

a. Provide not less than the number days of training indicated below.
1) DDC Control Systems - 2 days (16 hours)
2) Air Handlers - 1 day (8 hours)

b. Stagger training over multiple training classes to accommodate Owner's requirements. All training shall occur before end of warranty period.

C. Training Schedule:

1. Schedule training with Owner **20** business days before expected Substantial Completion.
2. Training shall occur within normal business hours at a mutually agreed on time. Unless otherwise agreed to, training shall occur Monday through Friday, except on U.S. Federal holidays, with two morning sessions and two afternoon sessions.
3. Provide staggered training schedule as requested by Owner.

D. Training Attendee List and Sign-in Sheet:

1. Request from Owner in advance of training a proposed attendee list with name, phone number and e-mail address.
2. Provide a preprinted sign-in sheet for each training session with proposed attendees listed and no fewer than six blank spaces to add additional attendees.
3. Circulate sign-in sheet at beginning of each session and solicit attendees to sign or initial in applicable location.
4. At end of each training day, send Owner an e-mail with an attachment of scanned copy (PDF) of circulated sign-in sheet for each session.

E. Attendee Training Manuals:

1. Provide each attendee with a color hard copy of all training materials and visual presentations.
2. Hard-copy materials shall be organized in a three-ring binder with table of contents and individual divider tabs marked for each logical grouping of subject matter. Organize material to provide space for attendees to take handwritten notes within training manuals.
3. In addition to hard-copy materials included in training manual, provide each binder with a sleeve or pocket that includes a DVD or flash drive with PDF copy of all hard-copy materials.

F. Organization of Training Sessions:

1. Organize training sessions into logical groupings of technical content and to reflect different levels of operators having access to system. Plan training sessions to accommodate the following three levels of operators:

    a. Daily operators.
    b. Advanced operators.
    c. System managers and administrators.

G. Training Outline:

1. Submit training outline for Owner review at least **10** business day before scheduling training.
2. Outline shall include a detailed agenda for each training day that is broken down into each of four training sessions that day, training objectives for each training session and synopses for each lesson planned.

H. On-Site Training:

1. Owner will provide conditioned classroom or workspace with ample desks or tables, chairs, power and data connectivity for instructor and each attendee.

2. Instructor shall provide training materials, projector and other audiovisual equipment used in training.
3. Provide as much of training located on-site as deemed feasible and practical by Owner.
4. On-site training shall include regular walk-through tours, as required, to observe each unique product type installed with hands-on review of operation, calibration and service requirements.
5. Operator workstation provided with DDC system shall be used in training. If operator workstation is not indicated, provide a temporary workstation to convey training content.

I. Training Content:

1. Basic operation of each system.
2. Understanding each unique product type installed including performance and service requirements for each.
3. Understanding operation of each system and equipment controlled by DDC system including sequences of operation, each unique control algorithm and each unique optimization routine.

END OF SECTION 230500

SECTION 230513

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.

B. Comply with NEMA MG 1 unless otherwise indicated.

C. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 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.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Energy efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Multispeed Motors: Separate winding for each speed.

F. Rotor: Random-wound, squirrel cage.

G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

H. Temperature Rise: Match insulation rating.

I. Insulation: Class F.

J. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. 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.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

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. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.

4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. 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.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230513

Construction Documents 6/12/24

SECTION 230519

METERS AND GAGES FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Thermometers.
2. Gages.
3. Test plugs.
4. Flowmeters.
5. Thermal-energy meters.

B. Related Sections:

1. Division 23 Section "Steam and Condensate Heating Piping" for steam and condensate meters.
2. Division 23 Section "Facility Natural-Gas Piping" for gas meters.

1.3 DEFINITIONS

A. CR: Chlorosulfonated polyethylene synthetic rubber.

B. EPDM: Ethylene-propylene-diene terpolymer rubber.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated; include performance curves.

B. Shop Drawings: Schedule for thermometers, gages, flowmeters and thermal-energy meters indicating manufacturer's number, scale range, and location for each.

C. Product Certificates: For each type of thermometer, gage, flowmeter and thermal-energy meter, signed by product manufacturer.

D. Operation and Maintenance Data: For flowmeters and thermal-energy meters to include operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 METAL-CASE, LIQUID-IN-GLASS THERMOMETERS

A. Case: Die-cast aluminum or brass, 7 inches long.

B. Tube: Red or blue reading, mercury or organic-liquid filled, with magnifying lens.

C. Tube Background: Satin-faced, nonreflective aluminum with permanently etched scale markings.

D. Window: Glass or plastic.

E. Connector: Adjustable type, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device.

F. Stem: Copper-plated steel, aluminum, or brass for thermowell installation and of length to suit installation.

G. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

2.2 DUCT-TYPE, LIQUID-IN-GLASS THERMOMETERS

A. Case: Die-cast aluminum, 7 inches long.

B. Tube: Red or blue reading, mercury or organic filled, with magnifying lens.

C. Tube Background: Satin-faced, nonreflective aluminum with permanently etched scale markings.

D. Window: Glass or plastic.

E. Connector: Adjustable type, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device.

F. Stem: Metal, for installation in mounting bracket and of length to suit installation.

G. Mounting Bracket: Flanged fitting for attachment to duct and made to hold thermometer stem.

H. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

2.3 THERMOWELLS

A. Manufacturers: Same as manufacturer of thermometer being used.

B. Description: Pressure-tight, socket-type metal fitting made for insertion into piping and of type, diameter, and length required to hold thermometer.

2.4 PRESSURE GAGES

A. Direct-Mounting, Dial-Type Pressure Gages: Indicating-dial type complying with ASME B40.100.

1. Case: Liquid-filled type, drawn steel or cast aluminum, 4-1/2-inch diameter.
2. Pressure-Element Assembly: Bourdon tube, unless otherwise indicated.
3. Pressure Connection: Brass, NPS 1/4, bottom-outlet type unless back-outlet type is indicated.
4. Movement: Mechanical, with link to pressure element and connection to pointer.
5. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
6. Pointer: Red metal.
7. Window: Glass or plastic.
8. Ring: Brass.
9. Accuracy: Grade A, plus or minus 1 percent of middle half scale.
10. Vacuum-Pressure Range: 30-in. Hg of vacuum to 15 psig of pressure.
11. Range for Fluids under Pressure: Two times operating pressure.

B. Remote-Mounting, Dial-Type Pressure Gages: ASME B40.100, indicating-dial type.

1. Case: Dry type, drawn steel or cast aluminum, 4-1/2-inch diameter for panel mounting.
2. Pressure-Element Assembly: Bourdon tube, unless otherwise indicated.
3. Pressure Connection: Brass, NPS 1/4, bottom-outlet type unless back-outlet type is indicated.
4. Movement: Mechanical, with link to pressure element and connection to pointer.
5. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
6. Pointer: Red metal.
7. Window: Glass or plastic.
8. Ring: Brass.
9. Accuracy: Grade A, plus or minus 1 percent of middle half scale.
10. Vacuum-Pressure Range: 30-in. Hg of vacuum to 15 psig of pressure.
11. Range for Fluids under Pressure: Two times operating pressure.

C. Pressure-Gage Fittings:

1. Valves: NPS 1/4 brass or stainless-steel needle type.
2. Syphons: NPS 1/4 coil of brass tubing with threaded ends.
3. Snubbers: ASME B40.5, NPS 1/4 brass bushing with corrosion-resistant, porous-metal disc of material suitable for system fluid and working pressure.

2.5 TEST PLUGS

A. Description: Corrosion-resistant brass or stainless-steel body with core inserts and gasketed and threaded cap, with extended stem for units to be installed in insulated piping.

B. Minimum Pressure and Temperature Rating: 300 psig at 250 deg F.

C. Core Inserts: One or two self-sealing rubber valves.

1. Insert material for air, water, oil, or gas service at 20 to 200 deg F shall be CR.

2. Insert material for air or water service at minus 30 to plus 275 deg F shall be EPDM.

D. Test Kit: Furnish one test kit(s) containing one pressure gage and adaptor, two thermometer(s), and carrying case. Pressure gage, adapter probes, and thermometer sensing elements shall be of diameter to fit test plugs and of length to project into piping.

1. Pressure Gage: Small bourdon-tube insertion type with 2- to 3-inch- diameter dial and probe. Dial range shall be 0 to 200 psig.
2. Low-Range Thermometer: Small bimetallic insertion type with 1- to 2-inch- diameter dial and tapered-end sensing element. Dial ranges shall be 25 to 125 deg F.
3. High-Range Thermometer: Small bimetallic insertion type with 1- to 2-inch- diameter dial and tapered-end sensing element. Dial ranges shall be 0 to 220 deg F.
4. Carrying case shall have formed instrument padding.

2.6 WAFER-ORIFICE FLOWMETERS

A. Description: Differential-pressure-design orifice insert for installation between pipe flanges; with calibrated flow-measuring element, separate flowmeter, hoses or tubing, valves, fittings, and conversion chart compatible with flow-measuring element, flowmeter, and system fluid.

B. Construction: Cast-iron body, brass valves with integral check valves and caps, and calibrated nameplate.

C. Pressure Rating: 300 psig.

D. Temperature Rating: 250 deg F.

E. Range: Flow range of flow-measuring element and flowmeter shall cover operating range of equipment or system served.

F. Permanent Indicators: Suitable for wall or bracket mounting, calibrated for connected flowmeter element, and having 6-inch- diameter, or equivalent, dial with fittings and copper tubing for connecting to flowmeter element.

1. Scale: Gallons per minute.
2. Accuracy: Plus or minus 1 percent between 20 and 80 percent of range.

G. Portable Indicators: Differential-pressure type calibrated for connected flowmeter element and having two 12-foot hoses in carrying case.

1. Scale: Gallons per minute.
2. Accuracy: Plus or minus 2 percent between 20 and 80 percent of range.

H. Operating Instructions: Include complete instructions with each flowmeter.

2.7 VENTURI FLOWMETERS

A. Description: Differential-pressure design for installation in piping; with calibrated flow-measuring element, separate flowmeter, hoses or tubing, valves, fittings, and conversion chart compatible with flow-measuring element, flowmeter, and system fluid.

B. Construction: Bronze, brass, or factory-primed steel; with brass fittings and attached tag with flow conversion data.

C. Pressure Rating: 300 psig.

D. Temperature Rating: 250 deg F.

E. End Connections for NPS 2 and Smaller: Threaded.

F. End Connections for NPS 2-1/2 and Larger: Flanged or welded.

G. Range: Flow range of flow-measuring element and flowmeter shall cover operating range of equipment or system served.

H. Permanent Indicators: Suitable for wall or bracket mounting, calibrated for connected flowmeter element, and having 6-inch- diameter, or equivalent, dial with fittings and copper tubing for connecting to flowmeter element.

1. Scale: Gallons per minute.
2. Accuracy: Plus or minus 1 percent between 20 and 80 percent of range.

I. Portable Indicators: Differential-pressure type calibrated for connected flowmeter element and having two 12-foot hoses in carrying case.

1. Scale: Gallons per minute.
2. Accuracy: Plus or minus 2 percent between 20 and 80 percent of range.

J. Operating Instructions: Include complete instructions with each flowmeter.

2.8 TURBINE FLOWMETERS

A. Description: Insertion type for inserting turbine into piping and measuring flow directly in gallons per minute.

B. Construction: Bronze or stainless-steel body; with plastic turbine or impeller and integral direct-reading scale.

C. Pressure Rating: 150 psig minimum.

D. Temperature Rating: 220 deg F. minimum.

E. Display: Visual instantaneous rate of flow.

F. Accuracy: Plus or minus 2-1/2 percent.

2.9 PITOT-TUBE FLOWMETERS

A. Description: Insertion-type, differential-pressure design for inserting probe into piping and measuring flow directly in gallons per minute.

B. Construction: Stainless-steel probe of length to span inside of pipe; with integral transmitter and direct-reading scale.

C. Pressure Rating: 150 psig minimum.

D. Temperature Rating: 220 deg F. minimum.

E. Display: Visual instantaneous rate of flow.

F. Integral Transformer: For low-voltage power connection.

G. Accuracy: Plus or minus 1 percent for liquids and gases.

2.10 FLOW INDICATORS

A. Description: Instrument for installation in piping systems for visual verification of flow.

B. Construction: Bronze or stainless-steel body; with sight glass and plastic pelton-wheel indicator, and threaded or flanged ends.

C. Pressure Rating: 150 psig.

D. Temperature Rating: 220 deg F.

E. End Connections for NPS 2 and Smaller: Threaded.

F. End Connections for NPS 2-1/2 and Larger: Flanged.

2.11 INSERTION-TURBINE, THERMAL-ENERGY METER SYSTEMS

A. Description: Flow sensor, strainer, two temperature sensors, transmitter, meter, and connecting wiring.

B. Flow Sensor: Insertion-type turbine or paddle-wheel element with corrosion-resistant-metal body and transmitter.

1. Pressure Rating: 150 psig.
2. Temperature Range: 40 to 250 deg F.

C. Meter: Solid-state integrating type.

1. Data Output: Six-digit electromechanical counter with readout in kilowatts per hour or British thermal units.
2. Accuracy: Plus or minus 1 percent.
3. Battery Pack: Five-year lithium battery.

D. Strainer: Full size of main line piping.

2.12 INLINE-TURBINE, THERMAL-ENERGY METER SYSTEMS

A. Description: Flow sensor, two temperature sensors, transmitter, meter, and connecting wiring.

B. Flow Sensor: Turbine-type water meter with corrosion-resistant-metal body and transmitter.

1. Pressure Rating: 150-psig minimum working-pressure rating.
2. Temperature Range: 40 to 250 deg F.

C. Meter: Solid-state integrating type.

1. Data Output: Six-digit electromechanical counter with readout in kilowatts per hour or British thermal units.
2. Accuracy: Plus or minus 1 percent.
3. Battery Pack: Five-year lithium battery.

D. Strainer: Full size of main line piping.

PART 3 - EXECUTION

3.1 THERMOMETER APPLICATIONS

A. Install liquid-in-glass thermometers as indicated on the drawings and in the following locations:

1. Inlet and outlet of each hydronic zone.
2. Inlet and outlet of each thermal storage tank.

B. Provide the following temperature ranges for thermometers:
1. Condenser Water: 30 to 120 deg F, with 2-degree scale divisions.
2. Air Ducts: Minus 40 to plus 110 deg F, with 2-degree scale divisions.

3.2 GAGE APPLICATIONS

A. Install dry-case-type pressure gages for discharge of each pressure-reducing valve.

B. Install liquid-filled-case-type pressure gages at suction and discharge of each pump.

3.3 INSTALLATIONS

A. Install direct-mounting thermometers and adjust vertical and tilted positions.

B. Install remote-mounting dial thermometers on panel, with tubing connecting panel and thermometer bulb supported to prevent kinks. Use minimum tubing length.

C. Install thermowells with socket extending one-third of diameter of pipe and in vertical position in piping tees where thermometers are indicated.

D. Duct Thermometer Support Flanges: Install in wall of duct where duct thermometers are indicated. Attach to duct with screws.

E. Install direct-mounting pressure gages in piping tees with pressure gage located on pipe at most readable position.

F. Install remote-mounting pressure gages on panel.

G. Install needle-valve and snubber fitting in piping for each pressure gage for fluids (except steam).

H. Install needle-valve and syphon fitting in piping for each pressure gage for steam.

I. Install test plugs in tees in piping.

J. Install flow indicators, in accessible positions for easy viewing, in piping systems.

K. Assemble and install connections, tubing, and accessories between flow-measuring elements and flowmeters as prescribed by manufacturer's written instructions.

L. Install flowmeter elements in accessible positions in piping systems.

M. Install differential-pressure-type flowmeter elements with at least minimum straight lengths of pipe upstream and downstream from element as prescribed by manufacturer's written instructions.

N. Install wafer-orifice flowmeter elements between pipe flanges.

O. Install permanent indicators on walls or brackets in accessible and readable positions.

P. Install connection fittings for attachment to portable indicators in accessible locations.

Q. Install flowmeters at discharge of hydronic system pumps and at inlet of hydronic air coils.

R. Assemble components and install thermal-energy meters.

S. Mount meters on wall if accessible; if not, provide brackets to support meters.

3.4 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance for meters, gages, machines, and equipment.

B. Connect flowmeter-system elements to meters.

C. Connect flowmeter transmitters to meters.

D. Connect thermal-energy-meter transmitters to meters.

3.5 ADJUSTING

A. Calibrate meters according to manufacturer's written instructions, after installation.

B. Adjust faces of meters and gages to proper angle for best visibility.

END OF SECTION 230519

Construction Documents 6/12/24

SECTION 230523

GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Brass ball valves.
2. Bronze ball valves.
3. Iron ball valves.
4. Iron, single-flange butterfly valves.
5. Iron, grooved-end butterfly valves.
6. High-performance butterfly valves.
7. Bronze swing check valves.
8. Iron swing check valves.
9. Iron swing check valves with closure control.
10. Iron, grooved-end swing-check valves.
11. Iron, center-guided check valves.
12. Iron, plate-type check valves.
13. Bronze gate valves.
14. Iron gate valves.
15. Bronze globe valves.
16. Iron globe valves.
17. Lubricated plug valves.
18. Eccentric plug valves.

B. Related Sections:

1. Division 23 HVAC piping Sections for specialty valves applicable to those Sections only.
2. Division 23 Section "Identification for HVAC Piping and Equipment" for valve tags and schedules.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. NRS: Nonrising stem.

E. OS&Y: Outside screw and yoke.

F. RS: Rising stem.

1.4 SUBMITTALS

A. Product Data: For each type of valve indicated.

1.5 ACCEPTABLE MANUFACTURERS

A. All valves shall be manufactured in the USA.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Valve Co.
2. Cameron
3. Conbraco Industries.
4. Hammond Valve
5. Milwaukee Valve Co.
6. NIBCO Inc.
7. Powell Valves
8. Watts Regulator Co

1.6 QUALITY ASSURANCE

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
2. ASME B31.1 for power piping valves.
3. ASME B31.9 for building services piping valves.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set angle, gate, and globe valves closed to prevent rattling.
4. Set ball and plug valves open to minimize exposure of functional surfaces.
5. Set butterfly valves closed or slightly open.
6. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to HVAC valve schedule articles for applications of valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

D. Valve Actuator Types:

1. Gear Actuator: For quarter-turn valves NPS 8 and larger.
2. Handwheel: For valves other than quarter-turn types.
3. Handlever: For quarter-turn valves NPS 6 and smaller.
4. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 10 plug valves, for each size square plug-valve head.

E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:

1. Gate Valves: With rising stem.
2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
3. Butterfly Valves: With extended neck.

F. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.
2. Grooved: With grooves according to AWWA C606.
3. Solder Joint: With sockets according to ASME B16.18.
4. Threaded: With threads according to ASME B1.20.1.

G. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRASS BALL VALVES

A. Three-Piece, Full-Port, Brass Ball Valves with Brass Trim:

1. Description:

   a. Standard: MSS SP-110.
   b. SWP Rating: 150 psig.
   c. CWP Rating: 600 psig.
   d. Body Design: Three piece.
   e. Body Material: Forged brass.
   f. Ends: Threaded.
   g. Seats: PTFE or TFE.
   h. Stem: Brass.
   i. Ball: Chrome-plated brass.
   j. Port: Full.

B. Three-Piece, Full-Port, Brass Ball Valves with Stainless-Steel Trim:

1. Description:

   a. Standard: MSS SP-110.
   b. SWP Rating: 150 psig.
   c. CWP Rating: 600 psig.
   d. Body Design: Three piece.
   e. Body Material: Forged brass.
   f. Ends: Threaded.
   g. Seats: PTFE or TFE.
   h. Stem: Stainless steel.
   i. Ball: Stainless steel, vented.
   j. Port: Full.

2.3 BRONZE BALL VALVES

A. Three-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

1. Description:

   a. Standard: MSS SP-110.
   b. SWP Rating: 150 psig.
   c. CWP Rating: 600 psig.
   d. Body Design: Three piece.
   e. Body Material: Bronze.
   f. Ends: Threaded.
   g. Seats: PTFE or TFE.
   h. Stem: Bronze.
   i. Ball: Chrome-plated brass.
   j. Port: Full.

B. Three-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:

1. Description:

   a. Standard: MSS SP-110.

b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Three piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Full.

2.4 IRON BALL VALVES

A. Class 150, Iron Ball Valves:

1. Description:

a. Standard: MSS SP-72.
b. CWP Rating: 200 psig.
c. Body Design: Split body.
d. Body Material: ASTM A 126, gray iron.
e. Ends: Flanged.
f. Seats: PTFE or TFE.
g. Stem: Stainless steel.
h. Ball: Stainless steel.
i. Port: Full.

2.5 IRON, SINGLE-FLANGE BUTTERFLY VALVES

A. 200 CWP, Iron, Single-Flange Butterfly Valves with NBR Seat and Aluminum-Bronze Disc:

1. Description:

a. Standard: MSS SP-67, Type I.
b. CWP Rating: 200 psig.
c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
e. Seat: NBR.
f. Stem: One- or two-piece stainless steel.
g. Disc: Aluminum bronze.

2.6 IRON, GROOVED-END BUTTERFLY VALVES

A. 175 CWP, Iron, Grooved-End Butterfly Valves:

1. Description:

a. Standard: MSS SP-67, Type I.

b. CWP Rating: 175 psig.
c. Body Material: Coated, ductile iron.
d. Stem: Two-piece stainless steel.
e. Disc: Coated, ductile iron.
f. Seal: EPDM.

2.7 HIGH-PERFORMANCE BUTTERFLY VALVES

A. Class 150, Single-Flange, High-Performance Butterfly Valves:

1. Description:

a. Standard: MSS SP-68.
b. CWP Rating: 285 psig at 100 deg F.
c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
d. Body Material: Carbon steel, cast iron, ductile iron, or stainless steel.
e. Seat: Reinforced PTFE or metal.
f. Stem: Stainless steel; offset from seat plane.
g. Disc: Carbon steel.
h. Service: Bidirectional.

2.8 BRONZE SWING CHECK VALVES

A. Class 150, Bronze Swing Check Valves with Bronze Disc:

1. Description:

a. Standard: MSS SP-80, Type 3.
b. CWP Rating: 300 psig.
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: Bronze.

2.9 IRON SWING CHECK VALVES

A. Class 125, Iron Swing Check Valves with Metal Seats:

1. Description:

a. Standard: MSS SP-71, Type I.
b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
c. NPS 14 to NPS 24, CWP Rating: 150 psig.
d. Body Design: Clear or full waterway.
e. Body Material: ASTM A 126, gray iron with bolted bonnet.
f. Ends: Flanged.
g. Trim: Bronze.

h. Gasket: Asbestos free.

2.10 IRON SWING CHECK VALVES WITH CLOSURE CONTROL

A. Class 125, Iron Swing Check Valves with Lever- and Spring-Closure Control:

1. Description:

a. Standard: MSS SP-71, Type I.
b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
c. NPS 14 to NPS 24, CWP Rating: 150 psig.
d. Body Design: Clear or full waterway.
e. Body Material: ASTM A 126, gray iron with bolted bonnet.
f. Ends: Flanged.
g. Trim: Bronze.
h. Gasket: Asbestos free.
i. Closure Control: Factory-installed, exterior lever and spring.

2.11 IRON, GROOVED-END SWING CHECK VALVES

A. 300 CWP, Iron, Grooved-End Swing Check Valves:

1. Description:

a. CWP Rating: 300 psig.
b. Body Material: ASTM A 536, ductile iron.
c. Seal: EPDM.
d. Disc: Spring operated, ductile iron or stainless steel.

2.12 IRON, CENTER-GUIDED CHECK VALVES

A. Class 150, Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat:

1. Description:

a. Standard: MSS SP-125.
b. NPS 2-1/2 to NPS 12, CWP Rating: 300 psig.
c. NPS 14 to NPS 24, CWP Rating: 250 psig.
d. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
e. Style: Compact wafer.
f. Seat: EPDM or NBR.

2.13 IRON, PLATE-TYPE CHECK VALVES

A. Class 150, Iron, Dual-Plate Check Valves with Resilient Seat:

1. Description:

a. Standard: API 594.
b. NPS 2-1/2 to NPS 12, CWP Rating: 300 psig.
c. NPS 14 to NPS 24, CWP Rating: 250 psig.
d. Body Design: Wafer, spring-loaded plates.
e. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
f. Seat: EPDM or NBR.

2.14 BRONZE GATE VALVES

A. Class 150, NRS Bronze Gate Valves:

1. Description:

a. Standard: MSS SP-80, Type 1.
b. CWP Rating: 300 psig.
c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
d. Ends: Threaded.
e. Stem: Bronze.
f. Disc: Solid wedge; bronze.
g. Packing: Asbestos free.

2.15 IRON GATE VALVES

A. Class 125, OS&Y, Iron Gate Valves:

1. Description:

a. Standard: MSS SP-70, Type I.
b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
c. NPS 14 to NPS 24, CWP Rating: 150 psig.
d. Body Material: ASTM A 126, gray iron with bolted bonnet.
e. Ends: Flanged.
f. Trim: Bronze.
g. Disc: Solid wedge.
h. Packing and Gasket: Asbestos free.

2.16 BRONZE GLOBE VALVES

A. Class 150, Bronze Globe Valves with Bronze Disc:

1. Description:

a. Standard: MSS SP-80, Type 2.
b. CWP Rating: 300 psig.
c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
d. Ends: Threaded.
e. Stem and Disc: Bronze.
f. Packing: Asbestos free.

g. Handwheel: Malleable iron, bronze, or aluminum.

2.17 IRON GLOBE VALVES

A. Class 125, Iron Globe Valves:

1. Description:

a. Standard: MSS SP-85, Type I.
b. CWP Rating: 200 psig.
c. Body Material: ASTM A 126, gray iron with bolted bonnet.
d. Ends: Flanged.
e. Trim: Bronze.
f. Packing and Gasket: Asbestos free.

2.18 LUBRICATED PLUG VALVES

A. Class 125, Regular-Gland, Lubricated Plug Valves with Flanged Ends:

1. Description:

a. Standard: MSS SP-78, Type II.
b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
c. NPS 14 to NPS 24, CWP Rating: 150 psig.
d. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
e. Pattern: Regular or short.
f. Plug: Cast iron or bronze with sealant groove.

2.19 ECCENTRIC PLUG VALVES

A. 175 CWP, Eccentric Plug Valves with Resilient Seating.

1. Description:

a. Standard: MSS SP-108.
b. CWP Rating: 175 psig minimum.
c. Body and Plug: ASTM A 48/A 48M, gray iron; ASTM A 126, gray iron; or ASTM A 536, ductile iron.
d. Bearings: Oil-impregnated bronze or stainless steel.
e. Ends: Flanged.
f. Stem-Seal Packing: Asbestos free.
g. Plug, Resilient-Seating Material: Suitable for potable-water service unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install check valves for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge pin level.
2. Center-Guided and Plate-Type Check Valves: In horizontal or vertical position, between flanges.
3. Lift Check Valves: With stem upright and plumb.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball, butterfly valves.
2. Butterfly Valve Dead-End Service: Single-flange (lug) type.

3. Throttling Service except Steam: Globe, ball, or butterfly valves.
4. Throttling Service, Steam: Globe or butterfly valves.
5. Pump-Discharge Check Valves:

    a. NPS 2 and Smaller: Bronze swing check valves with bronze disc.
    b. NPS 2-1/2 and Larger: Iron swing check valves with lever and weight or with spring or iron, center-guided, metal or resilient-seat check valves.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

C. Select valves, except wafer types, with the following end connections:

1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
2. For Steel Piping, NPS 2 and Smaller: Threaded ends.
3. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
4. For Steel Piping, NPS 5 and Larger: Flanged ends.

3.5 CHILLED-WATER, CONDENSER WATER AND HOT WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:
1. Ball Valves: Three piece, full port, brass or bronze with brass trim.
2. Bronze Swing Check Valves: Class 150, bronze disc.
3. Bronze Gate Valves: Class 150, NRS, bronze.
4. Bronze Globe Valves: Class 150, bronze disc.

B. Pipe NPS 2-1/2 and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Iron Ball Valves, NPS 2-1/2 to NPS 10: Class 150.
3. Iron, Single-Flange Butterfly Valves, NPS 2-1/2 to NPS 12: 200 CWP, NBR seat, aluminum-bronze disc.
4. Iron, Grooved-End Butterfly Valves, NPS 2-1/2 to NPS 12: 175 CWP.
5. High-Performance Butterfly Valves: Class 150, single flange.
6. Iron Swing Check Valves: Class 125, metal seats.
7. Iron Swing Check Valves with Closure Control, NPS 2-1/2 to NPS 12: Class 125, lever and spring.
8. Iron, Grooved-End Check Valves, NPS 3 to NPS 12: 300 CWP.
9. Iron, Center-Guided Check Valves: Class 150, compact-wafer, resilient seat.
10. Iron, Plate-Type Check Valves: Class 150; single plate; resilient seat.
11. Iron Gate Valves: Class 125, OS&Y.
12. Iron Globe Valves: Class 125.
13. Lubricated Plug Valves: Class 125, flanged.
14. Eccentric Plug Valves: 175 CWP, resilient seating.

END OF SECTION 230523

Construction Documents 6/12/24

SECTION 23 05 29

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following hangers and supports for HVAC system piping and equipment:

1. Steel pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Pipe stands.
7. Equipment supports.

B. Related Sections include the following:

1. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Division 21 Section "Water-Based Fire-Suppression Systems" for pipe hangers for fire-protection piping.
3. Division 23 Section " Expansion Fittings and Loops for HVAC Piping" for pipe guides and anchors.
4. Division 23 Section " Vibration and Seismic Controls for HVAC Piping and Equipment" for vibration isolation devices.
5. Division 23 Section(s) " Metal Ducts" for duct hangers and supports.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Steel pipe hangers and supports.
2. Fiberglass pipe hangers.
3. Thermal-hanger shield inserts.
4. Powder-actuated fastener systems.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers. Include Product Data for components.
2. Metal framing systems. Include Product Data for components.
3. Pipe stands. Include Product Data for components.
4. Equipment supports.

C. Welding certificates.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel.", AWS D1.3, "Structural Welding Code--Sheet Steel.", AWS D1.4, "Structural Welding Code--Reinforcing Steel." and ASME Boiler and Pressure Vessel Code: Section IX.

B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.2, "Structural Welding Code--Aluminum."
3. AWS D1.3, "Structural Welding Code--Sheet Steel."
4. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
5. ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 STEEL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

B. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.

C. Nonmetallic Coatings: Plastic coating, jacket, or liner.

D. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.4 METAL FRAMING SYSTEMS

A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

B. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.

C. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.5 THERMAL-HANGER SHIELD INSERTS

A. Description: 100-psig- minimum, compressive-strength insulation insert encased in sheet metal shield.

B. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass with vapor barrier.

C. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.6 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.7 PIPE STAND FABRICATION

A. Pipe Stands, General: Shop or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand: One-piece plastic unit with integral-rod-roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

C. Low-Type, Single-Pipe Stand: One-piece plastic base unit with plastic roller, for roof installation without membrane penetration.

D. High-Type, Single-Pipe Stand: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.

1. Base: Plastic.
2. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
3. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

E. High-Type, Multiple-Pipe Stand: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.

1. Bases: One or more plastic.
2. Vertical Members: Two or more protective-coated-steel channels.
3. Horizontal Member: Protective-coated-steel channel.
4. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

F. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe support made from structural-steel shape, continuous-thread rods, and rollers for mounting on permanent stationary roof curb.

2.8 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.9 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Non staining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use padded hangers for plastic piping and piping that is subject to scratching.

F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated stationary pipes, NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24, if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of non-insulated stationary pipes, NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of non-insulated stationary pipes, NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of non-insulated stationary pipes, NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of non-insulated stationary pipes, NPS 1/2 to NPS 2.
10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of non-insulated stationary pipes, NPS 3/8 to NPS 8.
11. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of non-insulated stationary pipes, NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
16. Adjustable, Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36, if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
17. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30, from 2 rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20, from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24, if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30, if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.

H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical type supports and one trapeze member.

L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

N. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

3.2 HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

C. Install hangers for plastic piping, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

D. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

E. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

F. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

G. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb-Mounting-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. Refer to Division 07 Section "Roof Accessories" for curbs.

H. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

I. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

J. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

K. Install lateral bracing with pipe hangers and supports to prevent swaying.

L. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

M. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

N. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.

O. Insulated Piping: Comply with the following:

1. Attach clamps and spacers to piping.

    a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    c. Do not exceed pipe stress limits according to ASME B31.1 for power piping and ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

    a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
    b. NPS 4: 12 inches long and 0.06 inch thick.
    c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
    d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
    e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

5. Pipes NPS 8 and Larger: Include wood inserts.
6. Insert Material: Length at least as long as protective shield.
7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 2".

3.6 PAINTING

A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 230548

VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Isolation pads.
2. Isolation mounts.
3. Freestanding and restrained spring isolators.
4. Housed spring mounts.
5. Spring hangers.
6. Spring hangers with vertical-limit stops.
7. Seismic snubbers.
8. Restraining braces and cables.

1.3 DEFINITIONS

A. IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

1.4 PERFORMANCE REQUIREMENTS

A. The Mechanical Contractor shall be responsible for providing restraints to resist the earthquake effects on the mechanical system. The requirements for these restraints are found in the North Carolina State Building Code and ASCE 7.

B. The Mechanical Contractor shall refer to the latest edition of the "Seismic Restraint Manual Guidelines for Mechanical System" published by SMACNA for guidelines to determine the correct restraints for sheet metal ducts, piping, and conduit, etc.

C. The Mechanical Contractor shall retain the services of a Professional Structural Engineer registered in the State of North Carolina to design seismic restraint elements required for this project. The engineer's computations, bearing his professional seal, shall accompany shop drawings which show Code compliance. Computations and shop drawings shall be submitted for review prior to the purchasing of materials, equipment systems, and assemblies.

D. The professional engineer retained by the Mechanical Contractor for seismic restraint calculations shall visit the job site upon completion of the seismic restraint installation. This Engineer shall provide in writing verification of compliance with the approved seismic submittal. This verification shall bear the Engineer's professional seal. Job site inspection by other than this Engineer is not acceptable. This engineer shall also be responsible for any required special inspections and associated documentation related to seismic restraints.

E. Seismic-Restraint Loading:

1. Site Class as Defined in the NC State Building Code (Chapter 16) and ASCE 7, as determined by the project Structural Engineer of record.
2. Assigned Seismic Use Group or Building Category as Defined in the NC State Building Code (Chapter 16) and ASCE 7.

    a. Component Importance Factor.
    b. Component Response Modification Factor.
    c. Component Amplification Factor.

3. Design Spectral Response Acceleration at Short Periods (0.2 Second).
4. Design Spectral Response Acceleration at 1-Second Period.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.

    a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.
    b. Annotate to indicate application of each product submitted and compliance with requirements.

3. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.

B. Delegated-Design Submittal: For vibration isolation and seismic-restraint details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic forces required to select vibration isolators, seismic restraints, and for designing vibration isolation bases.

    a. Coordinate design calculations with wind load calculations required for equipment mounted outdoors. Comply with requirements in other Division 22 Sections for equipment mounted outdoors.

2. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system has been examined for excessive stress and that none will exist.
3. Vibration Isolation Base Details: Detail overall dimensions, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.
4. Seismic-Restraint Details:

    a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
    b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
    c. Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Division 22 Sections for equipment mounted outdoors.
    d. Preapproval and Evaluation Documentation: By an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

C. Coordination Drawings: Show coordination of seismic bracing for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and seismic restraints.

D. Welding certificates.

E. Qualification Data: For professional engineer and testing agency.

F. Review of the seismic design and shop drawings by the Engineer/Architect or his agent shall not relieve the Contractor of his responsibility to comply with the seismic or any other requirements of the North Carolina State Building Code, Section 1607.

1.6 QUALITY ASSURANCE

A. The professional Engineer retained by the Mechanical Contractor for seismic restraint calculations shall visit the job site upon completion of the seismic restraint installation. This Engineer shall provide in writing verification of compliance with the approved seismic submittal. This verification shall bear the Engineer's professional seal. Job site inspection by other than this Engineer is not acceptable.

B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
1. Kinetics Noise Control.
2. Mason Industries.
3. Vibration Eliminator Co., Inc.
4. Vibration Isolation.
5. Vibration Mountings & Controls, Inc.

B. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

1. Resilient Material: Oil- and water-resistant neoprene.

C. Mounts: Double-deflection type, with molded, oil-resistant rubber, hermetically sealed compressed fiberglass, or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.

1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

D. Restrained Mounts: All-directional mountings with seismic restraint.

1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

E. Spring Isolators: Freestanding, laterally stable, open-spring isolators.

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig.
6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

F. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch- thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
2. Restraint: Seismic or limit stop as required for equipment and authorities having jurisdiction.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

G. Housed Spring Mounts: Housed spring isolator with integral seismic snubbers.

1. Housing: Ductile-iron or steel housing to provide all-directional seismic restraint.
2. Base: Factory drilled for bolting to structure.
3. Snubbers: Vertically adjustable to allow a maximum of 1/4-inch travel up or down before contacting a resilient collar.

H. Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
7. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

I. Spring Hangers with Vertical-Limit Stop: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression and with a vertical-limit stop.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
8. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

2.2 VIBRATION ISOLATION EQUIPMENT BASES

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
1. Mason Industries.
2. Vibration Eliminator Co., Inc.
3. Vibration Isolation.
4. Vibration Mountings & Controls, Inc.

2.3 SEISMIC-RESTRAINT DEVICES

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. Hilti, Inc.
2. Kinetics Noise Control.
3. Mason Industries.

B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

C. Snubbers: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.

1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
2. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
3. Maximum 1/4-inch air gap, and minimum 1/4-inch- thick resilient cushion.

D. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.

E. Restraint Cables: ASTM A 603 galvanized-steel cables with end connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.

F. Hanger Rod Stiffener: Reinforcing steel angle clamped to hanger rod.

G. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

H. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.

I. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

J. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.

K. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.4 FACTORY FINISHES

A. Finish: Manufacturer's standard prime-coat finish ready for field painting.

B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.

1. Powder coating on springs and housings.
2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
3. Baked enamel or powder coat for metal components on isolators for interior use.
4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.

B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.3 VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Comply with requirements in Division 07 Section "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.

B. Equipment Restraints:

1. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
3. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.

C. Piping Restraints:

1. Comply with requirements in MSS SP-127.
2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
3. Brace a change of direction longer than 12 feet.

D. Install cables so they do not bend across edges of adjacent equipment or building structure.

E. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.

F. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

G. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

H. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

I. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Division 22 Section "Hydronic Piping" for piping flexible connections.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. Measure isolator restraint clearance.
7. Measure isolator deflection.
8. Verify snubber minimum clearances.
9. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

3.6 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust active height of spring isolators.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION 230548

SECTION 230553

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Valve tags.

1.2 SUBMITTAL

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment (Note: Plastic Labels utilized in a return air plenum shall be listed and approved for use in a return air plenum):

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: White.
3. Background Color: Red.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: Red.

C. Background Color: White.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction. (Note: Plastic Labels utilized in a return air plenum shall be listed and approved for use in a return air plenum):

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches high.

2.4 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire-link or beaded chain.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

C. Major mechanical equipment shall include:

a. All AC units and heat pump units (split or packaged, water or air cooled)
b. Pumps
c. Fans
d. Expansion Tanks
e. Air Separators

3.3 PIPE LABEL INSTALLATION

A. Piping Color-Coding: Painting of piping is specified in Division 09.

B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.

4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

C. Pipe Label Color Schedule:

1. Geothermal/Condenser-Water Piping:
   a. Background Color: Green.
   b. Letter Color: White.

2. Refrigerant Piping:

   a. Background Color: Yellow.
   b. Letter Color: Black.

3. Drain Piping:

   a. Background Color: Yellow.
   b. Letter Color: Black.

3.4 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; and shutoff valves. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:

   a. Geothermal/Condenser Water: 2 inches, round.
   b. Refrigerant: 2 inches, round.
   c. Gas: 2 inches, round.

2. Valve-Tag Color:

   a. Geothermal/Condenser Water: Natural.
   b. Refrigerant: Natural.
   c. Gas: Natural.

3. Letter Color:

   a. Geothermal/Condenser Water: Black.
   b. Refrigerant: Black.
   c. Gas: Black.

3.5 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 230553

Construction Documents 6/12/24

SECTION 230593

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes TAB to produce design objectives for the following:

1. Air Systems:

    a. Constant-volume air systems.
    b. Dual-duct systems.
    c. Variable-air-volume systems.
    d. Multizone systems.
    e. Induction-unit systems.

2. Hydronic Piping Systems:

    a. Constant-flow systems.
    b. Variable-flow systems.
    c. Primary-secondary systems.

3. Steam systems.
4. HVAC equipment quantitative-performance settings.
5. Kitchen hood airflow balancing.
6. Laboratory fume hood airflow balancing.
7. Exhaust hood airflow balancing.
8. Space pressurization testing and adjusting.
9. Vibration measuring.
10. Sound level measuring.
11. Stair-tower pressurization testing and adjusting.
12. Smoke-control systems testing and adjusting.
13. Indoor-air quality measuring.
14. Existing systems TAB.
15. Verifying that automatic control devices are functioning properly.
16. Reporting results of activities and procedures specified in this Section.

1.3 DEFINITIONS

A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.

B. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to indicated quantities.

C. Barrier or Boundary: Construction, either vertical or horizontal, such as walls, floors, and ceilings that are designed and constructed to restrict the movement of airflow, smoke, odors, and other pollutants.

D. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.

E. NC: Noise criteria.

F. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.

G. RC: Room criteria.

H. Report Forms: Test data sheets for recording test data in logical order.

I. Smoke-Control System: An engineered system that uses fans to produce airflow and pressure differences across barriers to limit smoke movement.

J. Smoke-Control Zone: A space within a building that is enclosed by smoke barriers and is a part of a zoned smoke-control system.

K. Stair Pressurization System: A type of smoke-control system that is intended to positively pressurize stair towers with outdoor air by using fans to keep smoke from contaminating the stair towers during an alarm condition.

L. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.

M. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.

N. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

O. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.

P. TAB: Testing, adjusting, and balancing.

Q. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.

R. Test: A procedure to determine quantitative performance of systems or equipment.

S. Testing, Adjusting, and Balancing (TAB) Firm: The entity responsible for performing and reporting TAB procedures.

1.4 SUBMITTALS

A. Qualification Data: Within 15 days from Contractor's Notice to Proceed, submit 4 copies of evidence that TAB firm and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contract Documents Examination Report: Within 30 days from Contractor's Notice to Proceed, submit 4 copies of the Contract Documents review report as specified in Part 3.

C. Strategies and Procedures Plan: Within 60 days from Contractor's Notice to Proceed, submit 4 copies of TAB strategies and step-by-step procedures as specified in Part 3 "Preparation" Article. Include a complete set of report forms intended for use on this Project.

D. Certified TAB Reports: Submit two copies of reports prepared, as specified in this Section, on approved forms certified by TAB firm.

E. Sample Report Forms: Submit two sets of sample TAB report forms.

F. Warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. TAB Firm Qualifications: Engage a TAB firm certified by AABC or NEBB.

B. TAB Conference: Meet with Owner's and Architect's representatives on approval of TAB strategies and procedures plan to develop a mutual understanding of the details. Ensure the participation of TAB team members, equipment manufacturers' authorized service representatives, HVAC controls installers, and other support personnel. Provide seven days' advance notice of scheduled meeting time and location.

1. Agenda Items: Include at least the following:

    a. Submittal distribution requirements.
    b. The Contract Documents examination report.
    c. TAB plan.
    d. Work schedule and Project-site access requirements.
    e. Coordination and cooperation of trades and subcontractors.
    f. Coordination of documentation and communication flow.

C. Certification of TAB Reports: Certify TAB field data reports. This certification includes the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.

2. Certify that TAB team complied with approved TAB plan and the procedures specified and referenced in this Specification.

D. TAB Report Forms: Use standard forms from AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems." or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems."

E. Instrumentation Type, Quantity, and Accuracy: As described in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," Section II, "Required Instrumentation for NEBB Certification."

F. Instrumentation Calibration: Calibrate instruments at least every six months or more frequently if required by instrument manufacturer.

1. Keep an updated record of instrument calibration that indicates date of calibration and the name of party performing instrument calibration.

G. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2007, Section 7.2.2 - "Air Balancing."

H. ASHRAE/IESNA 90.1-2007 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2007, Section 6.7.2.3 - "System Balancing."

1.6 COORDINATION

A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.

B. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

C. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

1.7 WARRANTY

A. National Project Performance Guarantee: Provide a guarantee on AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" forms stating that AABC will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee includes the following provisions:

1. The certified TAB firm has tested and balanced systems according to the Contract Documents.
2. Systems are balanced to optimum performance capabilities within design and installation limits.

B. Special Guarantee: Provide a guarantee on NEBB forms stating that NEBB will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee shall include the following provisions:

1. The certified TAB firm has tested and balanced systems according to the Contract Documents.
2. Systems are balanced to optimum performance capabilities within design and installation limits.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

1. Contract Documents are defined in the General and Supplementary Conditions of Contract.
2. Verify that balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.

B. Examine approved submittal data of HVAC systems and equipment.

C. Examine Project Record Documents described in Division 01 Section "Project Record Documents."

D. Examine design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine equipment performance data including fan and pump curves. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system. Calculate system effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10; or in SMACNA's "HVAC Systems--Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.

F. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Sections have been performed.

G. Examine system and equipment test reports.

H. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and that their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.

I. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.

J. Examine HVAC equipment to ensure that clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

K. Examine terminal units, such as variable-air-volume boxes, to verify that they are accessible and their controls are connected and functioning.

L. Examine plenum ceilings used for supply air to verify that they are airtight. Verify that pipe penetrations and other holes are sealed.

M. Examine strainers for clean screens and proper perforations.

N. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.

O. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

P. Examine system pumps to ensure absence of entrained air in the suction piping.

Q. Examine equipment for installation and for properly operating safety interlocks and controls.

R. Examine automatic temperature system components to verify the following:

1. Dampers, valves, and other controlled devices are operated by the intended controller.
2. Dampers and valves are in the position indicated by the controller.
3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multizone units, mixing boxes, and variable-air-volume terminals.
4. Automatic modulating and shutoff valves, including two-way valves and three-way mixing and diverting valves, are properly connected.
5. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.
6. Sensors are located to sense only the intended conditions.
7. Sequence of operation for control modes is according to the Contract Documents.
8. Controller set points are set at indicated values.
9. Interlocked systems are operating.
10. Changeover from heating to cooling mode occurs according to indicated values.

S. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Complete system readiness checks and prepare system readiness reports. Verify the following:

1. Permanent electrical power wiring is complete.
2. Hydronic systems are filled, clean, and free of air.
3. Automatic temperature-control systems are operational.
4. Equipment and duct access doors are securely closed.
5. Balance, smoke, and fire dampers are open.
6. Isolating and balancing valves are open and control valves are operational.
7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems", NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and this Section.

1. Comply with requirements in ASHRAE 62.1-2007, Section 7.2.2 - "Air Balancing."

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to insulation Specifications for this Project.

C. Mark equipment and balancing device settings with paint or other suitable, permanent identification material, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct airflow measurements.

E. Check airflow patterns from the outside-air louvers and dampers and the return- and exhaust-air dampers, through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling unit components.

L. Check for proper sealing of air duct system.

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure fan static pressures to determine actual static pressure as follows:

    a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.
    b. Measure static pressure directly at the fan outlet or through the flexible connection.
    c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.
    d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

2. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.

    a. Simulate dirty filter operation and record the point at which maintenance personnel must change filters.

3. Measure static pressures entering and leaving other devices such as sound traps, heat recovery equipment, and air washers, under final balanced conditions.
4. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Compare actual system effect factors with calculated system effect factors to identify where variations occur. Recommend corrective action to align design and actual conditions.
5. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Make required adjustments to pulley sizes, motor sizes, and electrical connections to accommodate fan-speed changes.
6. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor

amperage to ensure that no overload will occur. Measure amperage in full cooling, full heating, economizer, and any other operating modes to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.

a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure terminal outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust terminal outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

A. Compensating for Diversity: When the total airflow of all terminal units is more than the indicated airflow of the fan, place a selected number of terminal units at a maximum set-point airflow condition until the total airflow of the terminal units equals the indicated airflow of the fan. Select the reduced airflow terminal units so they are distributed evenly among the branch ducts.

B. Pressure-Independent, Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

1. Set outside-air dampers at minimum, and return- and exhaust-air dampers at a position that simulates full-cooling load.
2. Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure static pressure. Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
3. Measure total system airflow. Adjust to within indicated airflow.

4. Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use terminal-unit manufacturer's written instructions to make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units as described for constant-volume air systems.
5. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow as described for constant-volume air systems.

    a. If air outlets are out of balance at minimum airflow, report the condition but leave outlets balanced for maximum airflow.

6. Remeasure the return airflow to the fan while operating at maximum return airflow and minimum outside airflow. Adjust the fan and balance the return-air ducts and inlets as described for constant-volume air systems.
7. Measure static pressure at the most critical terminal unit and adjust the static-pressure controller at the main supply-air sensing station to ensure that adequate static pressure is maintained at the most critical unit.
8. Record the final fan performance data.

C. Pressure-Dependent, Variable-Air-Volume Systems without Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

1. Balance systems similar to constant-volume air systems.
2. Set terminal units and supply fan at full-airflow condition.
3. Adjust inlet dampers of each terminal unit to indicated airflow and verify operation of the static-pressure controller. When total airflow is correct, balance the air outlets downstream from terminal units as described for constant-volume air systems.
4. Readjust fan airflow for final maximum readings.
5. Measure operating static pressure at the sensor that controls the supply fan, if one is installed, and verify operation of the static-pressure controller.
6. Set supply fan at minimum airflow if minimum airflow is indicated. Measure static pressure to verify that it is being maintained by the controller.
7. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow as described for constant-volume air systems.

    a. If air outlets are out of balance at minimum airflow, report the condition but leave the outlets balanced for maximum airflow.

8. Measure the return airflow to the fan while operating at maximum return airflow and minimum outside airflow. Adjust the fan and balance the return-air ducts and inlets as described for constant-volume air systems.

D. Pressure-Dependent, Variable-Air-Volume Systems with Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

1. Set system at maximum indicated airflow by setting the required number of terminal units at minimum airflow. Select the reduced airflow terminal units so they are distributed evenly among the branch ducts.
2. Adjust supply fan to maximum indicated airflow with the variable-airflow controller set at maximum airflow.

3. Set terminal units at full-airflow condition.
4. Adjust terminal units starting at the supply-fan end of the system and continuing progressively to the end of the system. Adjust inlet dampers of each terminal unit to indicated airflow. When total airflow is correct, balance the air outlets downstream from terminal units as described for constant-volume air systems.
5. Adjust terminal units for minimum airflow.
6. Measure static pressure at the sensor.
7. Measure the return airflow to the fan while operating at maximum return airflow and minimum outside airflow. Adjust the fan and balance the return-air ducts and inlets as described for constant-volume air systems.

3.7 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

A. Prepare test reports with pertinent design data and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against approved pump flow rate. Correct variations that exceed plus or minus 5 percent.

B. Prepare schematic diagrams of systems' "as-built" piping layouts.

C. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:

1. Open all manual valves for maximum flow.
2. Check expansion tank liquid level.
3. Check makeup-water-station pressure gage for adequate pressure for highest vent.
4. Check flow-control valves for specified sequence of operation and set at indicated flow.
5. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type unless several terminal valves are kept open.
6. Set system controls so automatic valves are wide open to heat exchangers.
7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
8. Check air vents for a forceful liquid flow exiting from vents when manually operated.

3.8 PROCEDURES FOR HYDRONIC SYSTEMS

A. Measure water flow at pumps. Use the following procedures, except for positive-displacement pumps:

1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
2. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.
3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake

horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
4. Report flow rates that are not within plus or minus 5 percent of design.

B. Set calibrated balancing valves, if installed, at calculated presettings.

C. Measure flow at all stations and adjust, where necessary, to obtain first balance.

1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.

D. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.

E. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:

1. Determine the balancing station with the highest percentage over indicated flow.
2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.
3. Record settings and mark balancing devices.

F. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.

G. Measure the differential-pressure control valve settings existing at the conclusions of balancing.

3.9 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

A. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems.

3.10 PROCEDURES FOR PRIMARY-SECONDARY-FLOW HYDRONIC SYSTEMS

A. Balance the primary system crossover flow first, then balance the secondary system.

3.11 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer, model, and serial numbers.
2. Motor horsepower rating.
3. Motor rpm.
4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass for the controller to prove proper operation. Record observations, including controller manufacturer, model and serial numbers, and nameplate data.

3.12 PROCEDURES FOR CHILLERS

A. Balance water flow through each evaporator and condenser to within specified tolerances of indicated flow with all pumps operating. With only one chiller operating in a multiple chiller installation, do not exceed the flow for the maximum tube velocity recommended by the chiller manufacturer. Measure and record the following data with each chiller operating at design conditions:

1. Evaporator-water entering and leaving temperatures, pressure drop, and water flow.
2. If water-cooled chillers, condenser-water entering and leaving temperatures, pressure drop, and water flow.
3. Evaporator and condenser refrigerant temperatures and pressures, using instruments furnished by chiller manufacturer.
4. Power factor if factory-installed instrumentation is furnished for measuring kilowatt.
5. Kilowatt input if factory-installed instrumentation is furnished for measuring kilowatt.
6. Capacity: Calculate in tons of cooling.
7. If air-cooled chillers, verify condenser-fan rotation and record fan and motor data including number of fans and entering- and leaving-air temperatures.

3.13 PROCEDURES FOR COOLING TOWERS

A. Shut off makeup water for the duration of the test, and verify that makeup and blowdown systems are fully operational after tests and before leaving the equipment. Perform the following tests and record the results:

1. Measure condenser-water flow to each cell of the cooling tower.
2. Measure entering- and leaving-water temperatures.
3. Measure wet- and dry-bulb temperatures of entering air.
4. Measure wet- and dry-bulb temperatures of leaving air.
5. Measure condenser-water flow rate recirculating through the cooling tower.
6. Measure cooling tower pump discharge pressure.
7. Adjust water level and feed rate of makeup-water system.

3.14 PROCEDURES FOR CONDENSING UNITS

A. Verify proper rotation of fans.

B. Measure entering- and leaving-air temperatures.

C. Record compressor data.

3.15 PROCEDURES FOR BOILERS

A. If hydronic, measure entering- and leaving-water temperatures and water flow.

B. If steam, measure entering-water temperature and flow and leaving steam pressure, temperature, and flow.

3.16 PROCEDURES FOR HEAT-TRANSFER COILS

A. Water Coils: Measure the following data for each coil:

1. Entering- and leaving-water temperature.
2. Water flow rate.
3. Water pressure drop.
4. Dry-bulb temperature of entering and leaving air.
5. Wet-bulb temperature of entering and leaving air for cooling coils.
6. Airflow.
7. Air pressure drop.

B. Electric-Heating Coils: Measure the following data for each coil:

1. Nameplate data.
2. Airflow.
3. Entering- and leaving-air temperature at full load.
4. Voltage and amperage input of each phase at full load and at each incremental stage.
5. Calculated kilowatt at full load.
6. Fuse or circuit-breaker rating for overload protection.

C. Refrigerant Coils: Measure the following data for each coil:

1. Dry-bulb temperature of entering and leaving air.
2. Wet-bulb temperature of entering and leaving air.
3. Airflow.
4. Air pressure drop.
5. Refrigerant suction pressure and temperature.

3.17 PROCEDURES FOR TEMPERATURE MEASUREMENTS

A. During TAB, report the need for adjustment in temperature regulation within the automatic temperature-control system.

B. Measure indoor wet- and dry-bulb temperatures every other hour for a period of two successive eight-hour days, in each separately controlled zone, to prove correctness of final temperature settings. Measure when the building or zone is occupied.

C. Measure outside-air, wet- and dry-bulb temperatures.

3.18 PROCEDURES FOR COMMERCIAL KITCHEN HOODS

A. Measure, adjust, and record the airflow of each kitchen hood. For kitchen hoods designed with integral makeup air, measure and adjust the exhaust and makeup airflow. Measure airflow by duct Pitot-tube traverse. If a duct Pitot-tube traverse is not possible, provide an explanation in the report of the reason(s) why and also the reason why the method used was chosen.

1. Install welded test ports in the sides of the exhaust duct for the duct Pitot-tube traverse. Install each test port with a threaded cap that is liquid tight.

B. After balancing is complete, do the following:

1. Measure and record the static pressure at the hood exhaust-duct connection.
2. Measure and record the hood face velocity. Make measurements at multiple points across the face of the hood. Perform measurements at a maximum of 12 inches (300 mm) between points and between any point and the perimeter. Calculate the average of the measurements recorded. Verify that the hood average face velocity complies with the Contract Documents and governing codes.
3. Check the hood for capture and containment of smoke using a smoke emitting device. Observe the smoke pattern. Make adjustments to room airflow patterns to achieve optimum results.

C. Visually inspect the hood exhaust duct throughout its entire length in compliance with authorities having jurisdiction. Begin at the hood connection and end at the point it discharges outdoors. Report findings.

1. Check duct slopes as required.
2. Verify that duct access is installed as required.
3. Verify that point of termination is as required.
4. Verify that duct air velocity is within the range required.
5. Verify that duct is within a fire-rated enclosure.

D. Report deficiencies.

3.19 PROCEDURES FOR LABORATORY FUME HOODS

A. Before performing laboratory fume hood testing, measure, adjust and record the supply airflow and airflow patterns of each supply air outlet that is located in the same room as the hood. Adjust the air outlet flow pattern to minimize turbulence and to achieve the desired airflow patterns at the face and inside the hood. Verify that adequate makeup air is available to achieve the indicated flow of the hood.

B. Measure, adjust, and record the airflow of each laboratory fume hood by duct Pitot-tube traverse with the laboratory fume hood sash in the design open position.

1. For laboratory fume hoods installed in variable exhaust systems, measure, adjust, and record the hood exhaust airflow at maximum and at minimum airflow conditions.
2. For laboratory fume hoods designed with integral makeup air, measure, adjust, and record the exhaust and makeup airflow.

C. For laboratory fume hoods that are connected to centralized exhaust systems using automatic dampers, adjust the damper controller to obtain the indicated exhaust airflow.

D. After balancing is complete, do the following:

1. Measure and record the static pressure at the hood duct connection with the hood operating at indicated airflow.
2. Measure and record the face velocity across the open sash face area. Measure the face velocity at each point in a grid pattern. Perform measurements at a maximum of 12 inches between points and between any point and the perimeter of the opening.

    a. For laboratory fume hoods designed to maintain a constant face velocity at varying sash positions, also measure and record the face velocity at 50 and 25 percent of the design open sash position.
    b. Calculate and report the average face velocity by averaging all velocity measurements.
    c. Calculate and report the exhaust airflow by multiplying the calculated average face velocity by the sash open area. Compare this quantity with the exhaust airflow measured by duct Pitot-tube traverse. Report differences.
    d. If the average face velocity is less than the indicated face velocity, retest the average face velocity and adjust hood baffles, fan drives, and other parts of the system to provide the indicated average face velocity.

3. Check each laboratory fume hood for the capture and containment of smoke by using a hand-held emitting device. Observe the capture and containment of smoke flow pattern across the open face and inside the hood. Make adjustments necessary to achieve the desired results.

E. With the room and laboratory fume hoods operating at indicated conditions, perform an "as-installed" performance test of the laboratory fume hood according to ASHRAE 110. Test each laboratory fume hood(s) and document the test results.

3.20 PROCEDURES FOR EXHAUST HOODS

A. Measure, adjust, and record the airflow of each exhaust hood. Measure airflow by duct Pitot-tube traverse. If a duct Pitot-tube traverse is not possible, explain why, in the report, and explain the test method used.

B. After balancing is complete, do the following:

1. Measure and record the static pressure at the hood exhaust-duct connection.
2. Check the hood for capture and containment of smoke using a smoke emitting device. Observe the smoke pattern. Make adjustments to achieve optimum results.

3.21 PROCEDURES FOR SPACE PRESSURIZATION MEASUREMENTS AND ADJUSTMENTS

A. Before testing for space pressurization, observe the space to verify the integrity of the space boundaries. Verify that windows and doors are closed and applicable safing, gaskets, and

sealants are installed. Report deficiencies and postpone testing until after the reported deficiencies are corrected.

B. Measure, adjust, and record the pressurization of each room, each zone, and each building by adjusting the supply, return, and exhaust airflows to achieve the indicated conditions.

C. Measure space pressure differential where pressure is used as the design criteria, and measure airflow differential where differential airflow is used as the design criteria for space pressurization.

1. For pressure measurements, measure and record the pressure difference between the intended spaces at the door with all doors in the space closed. Record the high-pressure side, low-pressure side, and pressure difference between each adjacent space.
2. For applications with cascading levels of space pressurization, begin in the most critical space and work to the least critical space.
3. Test room pressurization first, then zones, and finish with building pressurization.

D. To achieve indicated pressurization, set the supply airflow to the indicated conditions and adjust the exhaust and return airflow to achieve the indicated pressure or airflow difference.

E. For spaces with pressurization being monitored and controlled automatically, observe and adjust the controls to achieve the desired set point.

1. Compare the values of the measurements taken to the measured values of the control system instruments and report findings.
2. Check the repeatability of the controls by successive tests designed to temporarily alter the ability to achieve space pressurization. Test overpressurization and underpressurization, and observe and report on the system's ability to revert to the set point.
3. For spaces served by variable-air-volume supply and exhaust systems, measure space pressurization at indicated airflow and minimum airflow conditions.

F. In spaces that employ multiple modes of operation, such as normal mode and emergency mode or occupied mode and unoccupied mode, measure, adjust, and record data for each operating mode.

G. Record indicated conditions and corresponding initial and final measurements. Report deficiencies.

3.22 TEMPERATURE-CONTROL VERIFICATION

A. Verify that controllers are calibrated and commissioned.

B. Check transmitter and controller locations and note conditions that would adversely affect control functions.

C. Record controller settings and note variances between set points and actual measurements.

D. Check the operation of limiting controllers (i.e., high- and low-temperature controllers).

E. Check free travel and proper operation of control devices such as damper and valve operators.

F. Check the sequence of operation of control devices. Note air pressures and device positions and correlate with airflow and water flow measurements. Note the speed of response to input changes.

G. Check the interaction of electrically operated switch transducers.

H. Check the interaction of interlock and lockout systems.

I. Check main control supply-air pressure and observe compressor and dryer operations.

J. Record voltages of power supply and controller output. Determine whether the system operates on a grounded or nongrounded power supply.

K. Note operation of electric actuators using spring return for proper fail-safe operations.

3.23 TOLERANCES

A. Set HVAC system airflow and water flow rates within the following tolerances (code required minimums must meet or exceed rates indicated on plans):

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Minus 5 to plus 10 percent.
2. Air Outlets and Inlets: minus 10 to plus 10 percent.
3. Heating-Water Flow Rate: minus 10 to plus 10 percent.
4. Cooling-Water Flow Rate: minus 10 to plus 10 percent.

3.24 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: As Work progresses, prepare reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.25 FINAL REPORT

A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in three-ring binder, tabulated and divided into sections by tested and balanced systems.

B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.

1. Include a list of instruments used for procedures, along with proof of calibration.

C. Final Report Contents: In addition to certified field report data, include the following:

1. Pump curves.
2. Fan curves.
3. Manufacturers' test data.
4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance, but do not include Shop Drawings and Product Data.

D. General Report Data: In addition to form titles and entries, include the following data in the final report, as applicable:

1. Title page.
2. Name and address of TAB firm.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB firm who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer, type size, and fittings.
14. Notes to explain why certain final data in the body of reports varies from indicated values.
15. Test conditions for fans and pump performance forms including the following:

    a. Settings for outside-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Inlet vane settings for variable-air-volume systems.
    g. Settings for supply-air, static-pressure controller.
    h. Other system operating conditions that affect performance.

E. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outside, supply, return, and exhaust airflows.
2. Water and steam flow rates.
3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.
5. Terminal units.
6. Balancing stations.
7. Position of balancing devices.

F. Air-Handling Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data: Include the following:

   a. Unit identification.
   b. Location.
   c. Make and type.
   d. Model number and unit size.
   e. Manufacturer's serial number.
   f. Unit arrangement and class.
   g. Discharge arrangement.
   h. Sheave make, size in inches, and bore.
   i. Sheave dimensions, center-to-center, and amount of adjustments in inches.
   j. Number of belts, make, and size.
   k. Number of filters, type, and size.

2. Motor Data:

   a. Make and frame type and size.
   b. Horsepower and rpm.
   c. Volts, phase, and hertz.
   d. Full-load amperage and service factor.
   e. Sheave make, size in inches, and bore.
   f. Sheave dimensions, center-to-center, and amount of adjustments in inches.

3. Test Data (Indicated and Actual Values):

   a. Total airflow rate in cfm.
   b. Total system static pressure in inches wg.
   c. Fan rpm.
   d. Discharge static pressure in inches wg.
   e. Filter static-pressure differential in inches wg.
   f. Preheat coil static-pressure differential in inches wg.
   g. Cooling coil static-pressure differential in inches wg.
   h. Heating coil static-pressure differential in inches wg.
   i. Outside airflow in cfm.
   j. Return airflow in cfm.
   k. Outside-air damper position.
   l. Return-air damper position.
   m. Vortex damper position.

G. Apparatus-Coil Test Reports:

1. Coil Data:

a. System identification.
b. Location.
c. Coil type.
d. Number of rows.
e. Fin spacing in fins per inch o.c.
f. Make and model number.
g. Face area in sq. ft..
h. Tube size in NPS.
i. Tube and fin materials.
j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm.
b. Average face velocity in fpm.
c. Air pressure drop in inches wg.
d. Outside-air, wet- and dry-bulb temperatures in deg F.
e. Return-air, wet- and dry-bulb temperatures in deg F.
f. Entering-air, wet- and dry-bulb temperatures in deg F.
g. Leaving-air, wet- and dry-bulb temperatures in deg F.
h. Water flow rate in gpm.
i. Water pressure differential in feet of head or psig.
j. Entering-water temperature in deg F.
k. Leaving-water temperature in deg F.
l. Refrigerant expansion valve and refrigerant types.
m. Refrigerant suction pressure in psig.
n. Refrigerant suction temperature in deg F.
o. Inlet steam pressure in psig.

H. Gas- and Oil-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:

1. Unit Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and unit size.
e. Manufacturer's serial number.
f. Fuel type in input data.
g. Output capacity in Btuh.
h. Ignition type.
i. Burner-control types.
j. Motor horsepower and rpm.
k. Motor volts, phase, and hertz.
l. Motor full-load amperage and service factor.
m. Sheave make, size in inches, and bore.

n. Sheave dimensions, center-to-center, and amount of adjustments in inches.

2. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Entering-air temperature in deg F.
c. Leaving-air temperature in deg F.
d. Air temperature differential in deg F.
e. Entering-air static pressure in inches wg.
f. Leaving-air static pressure in inches wg.
g. Air static-pressure differential in inches wg.
h. Low-fire fuel input in Btuh.
i. High-fire fuel input in Btuh.
j. Manifold pressure in psig.
k. High-temperature-limit setting in deg F.
l. Operating set point in Btuh.
m. Motor voltage at each connection.
n. Motor amperage for each phase.
o. Heating value of fuel in Btuh.

I. Electric-Coil Test Reports: For electric furnaces, duct coils, and electric coils installed in central-station air-handling units, include the following:

1. Unit Data:

a. System identification.
b. Location.
c. Coil identification.
d. Capacity in Btuh.
e. Number of stages.
f. Connected volts, phase, and hertz.
g. Rated amperage.
h. Airflow rate in cfm.
i. Face area in sq. ft..
j. Minimum face velocity in fpm.

2. Test Data (Indicated and Actual Values):

a. Heat output in Btuh.
b. Airflow rate in cfm.
c. Air velocity in fpm.
d. Entering-air temperature in deg F.
e. Leaving-air temperature in deg F.
f. Voltage at each connection.
g. Amperage for each phase.

J. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

a. System identification.

b. Location.
c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches, and bore.
h. Sheave dimensions, center-to-center, and amount of adjustments in inches.

2. Motor Data:

a. Make and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Sheave dimensions, center-to-center, and amount of adjustments in inches.
g. Number of belts, make, and size.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Suction static pressure in inches wg.

K. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

a. System and air-handling unit number.
b. Location and zone.
c. Traverse air temperature in deg F.
d. Duct static pressure in inches wg.
e. Duct size in inches.
f. Duct area in sq. ft..
g. Indicated airflow rate in cfm.
h. Indicated velocity in fpm.
i. Actual airflow rate in cfm.
j. Actual average velocity in fpm.
k. Barometric pressure in psig.

L. Air-Terminal-Device Reports:

1. Unit Data:

a. System and air-handling unit identification.
b. Location and zone.
c. Test apparatus used.
d. Area served.

e. Air-terminal-device make.
f. Air-terminal-device number from system diagram.
g. Air-terminal-device type and model number.
h. Air-terminal-device size.
i. Air-terminal-device effective area in sq. ft..

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm.
b. Air velocity in fpm.
c. Preliminary airflow rate as needed in cfm.
d. Preliminary velocity as needed in fpm.
e. Final airflow rate in cfm.
f. Final velocity in fpm.
g. Space temperature in deg F.

M. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:

1. Unit Data:

a. System and air-handling unit identification.
b. Location and zone.
c. Room or riser served.
d. Coil make and size.
e. Flowmeter type.

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm.
b. Entering-water temperature in deg F.
c. Leaving-water temperature in deg F.
d. Water pressure drop in feet of head or psig.
e. Entering-air temperature in deg F.
f. Leaving-air temperature in deg F.

N. Packaged Chiller Reports:

1. Unit Data:

a. Unit identification.
b. Make and model number.
c. Manufacturer's serial number.
d. Refrigerant type and capacity in gal..
e. Starter type and size.
f. Starter thermal protection size.
g. Compressor make and model number.
h. Compressor manufacturer's serial number.

2. Water-Cooled Condenser Test Data (Indicated and Actual Values):

a. Refrigerant pressure in psig.

b. Refrigerant temperature in deg F.
c. Entering-water temperature in deg F.
d. Leaving-water temperature in deg F.
e. Entering-water pressure in feet of head or psig.
f. Water pressure differential in feet of head or psig.

3. Air-Cooled Condenser Test Data (Indicated and Actual Values):

a. Refrigerant pressure in psig.
b. Refrigerant temperature in deg F.
c. Entering- and leaving-air temperature in deg F.

4. Evaporator Test Reports (Indicated and Actual Values):

a. Refrigerant pressure in psig.
b. Refrigerant temperature in deg F.
c. Entering-water temperature in deg F.
d. Leaving-water temperature in deg F.
e. Entering-water pressure in feet of head or psig.
f. Water pressure differential in feet of head or psig.

5. Compressor Test Data (Indicated and Actual Values):

a. Suction pressure in psig.
b. Suction temperature in deg F.
c. Discharge pressure in psig.
d. Discharge temperature in deg F.
e. Oil pressure in psig.
f. Oil temperature in deg F.
g. Voltage at each connection.
h. Amperage for each phase.
i. Kilowatt input.
j. Crankcase heater kilowatt.
k. Chilled-water control set point in deg F.
l. Condenser-water control set point in deg F.
m. Refrigerant low-pressure-cutoff set point in psig.
n. Refrigerant high-pressure-cutoff set point in psig.

6. Refrigerant Test Data (Indicated and Actual Values):

a. Oil level.
b. Refrigerant level.
c. Relief valve setting in psig.
d. Unloader set points in psig.
e. Percentage of cylinders unloaded.
f. Bearing temperatures in deg F.
g. Vane position.
h. Low-temperature-cutoff set point in deg F.

O. Compressor and Condenser Reports: For refrigerant side of unitary systems, stand-alone refrigerant compressors, air-cooled condensing units, or water-cooled condensing units, include the following:

1. Unit Data:

a. Unit identification.
b. Location.
c. Unit make and model number.
d. Compressor make.
e. Compressor model and serial numbers.
f. Refrigerant weight in lb.
g. Low ambient temperature cutoff in deg F.

2. Test Data (Indicated and Actual Values):

a. Inlet-duct static pressure in inches wg.
b. Outlet-duct static pressure in inches wg.
c. Entering-air, dry-bulb temperature in deg F.
d. Leaving-air, dry-bulb temperature in deg F.
e. Condenser entering-water temperature in deg F.
f. Condenser leaving-water temperature in deg F.
g. Condenser-water temperature differential in deg F.
h. Condenser entering-water pressure in feet of head or psig.
i. Condenser leaving-water pressure in feet of head or psig.
j. Condenser-water pressure differential in feet of head or psig.
k. Control settings.
l. Unloader set points.
m. Low-pressure-cutout set point in psig.
n. High-pressure-cutout set point in psig.
o. Suction pressure in psig.
p. Suction temperature in deg F.
q. Condenser refrigerant pressure in psig.
r. Condenser refrigerant temperature in deg F.
s. Oil pressure in psig.
t. Oil temperature in deg F.
u. Voltage at each connection.
v. Amperage for each phase.
w. Kilowatt input.
x. Crankcase heater kilowatt.
y. Number of fans.
z. Condenser fan rpm.
aa. Condenser fan airflow rate in cfm.
bb. Condenser fan motor make, frame size, rpm, and horsepower.
cc. Condenser fan motor voltage at each connection.
dd. Condenser fan motor amperage for each phase.

P. Cooling Tower or Condenser Test Reports: For cooling towers or condensers, include the following:

1. Unit Data:

a. Unit identification.
b. Make and type.
c. Model and serial numbers.
d. Nominal cooling capacity in tons.
e. Refrigerant type and weight in lb.
f. Water-treatment chemical feeder and chemical.
g. Number and type of fans.
h. Fan motor make, frame size, rpm, and horsepower.
i. Fan motor voltage at each connection.
j. Sheave make, size in inches, and bore.
k. Sheave dimensions, center-to-center, and amount of adjustments in inches.
l. Number of belts, make, and size.
m. Pump make and model number.
n. Pump manufacturer's serial number.
o. Pump motor make and frame size.
p. Pump motor horsepower and rpm.

2. Pump Test Data (Indicated and Actual Values):

a. Voltage at each connection.
b. Amperage for each phase.
c. Water flow rate in gpm.

3. Water Test Data (Indicated and Actual Values):

a. Entering-water temperature in deg F.
b. Leaving-water temperature in deg F.
c. Water temperature differential in deg F.
d. Entering-water pressure in feet of head or psig.
e. Leaving-water pressure in feet of head or psig.
f. Water pressure differential in feet of head or psig.
g. Water flow rate in gpm.
h. Bleed water flow rate in gpm.

4. Air Data (Indicated and Actual Values):

a. Duct airflow rate in cfm.
b. Inlet-duct static pressure in inches wg.
c. Outlet-duct static pressure in inches wg.
d. Average entering-air, wet-bulb temperature in deg F.
e. Average leaving-air, wet-bulb temperature in deg F.
f. Ambient wet-bulb temperature in deg F.

Q. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:

1. Unit Data:

a. Unit identification.
b. Location.
c. Service.

d. Make and size.
e. Model and serial numbers.
f. Water flow rate in gpm.
g. Water pressure differential in feet of head or psig.
h. Required net positive suction head in feet of head or psig.
i. Pump rpm.
j. Impeller diameter in inches.
k. Motor make and frame size.
l. Motor horsepower and rpm.
m. Voltage at each connection.
n. Amperage for each phase.
o. Full-load amperage and service factor.
p. Seal type.

2. Test Data (Indicated and Actual Values):

a. Static head in feet of head or psig.
b. Pump shutoff pressure in feet of head or psig.
c. Actual impeller size in inches.
d. Full-open flow rate in gpm.
e. Full-open pressure in feet of head or psig.
f. Final discharge pressure in feet of head or psig.
g. Final suction pressure in feet of head or psig.
h. Final total pressure in feet of head or psig.
i. Final water flow rate in gpm.
j. Voltage at each connection.
k. Amperage for each phase.

R. Boiler Test Reports:

1. Unit Data:

a. Unit identification.
b. Location.
c. Service.
d. Make and type.
e. Model and serial numbers.
f. Fuel type and input in Btuh.
g. Number of passes.
h. Ignition type.
i. Burner-control types.
j. Voltage at each connection.
k. Amperage for each phase.

2. Test Data (Indicated and Actual Values):

a. Operating pressure in psig.
b. Operating temperature in deg F.
c. Entering-water temperature in deg F.
d. Leaving-water temperature in deg F.
e. Number of safety valves and sizes in NPS.

f. Safety valve settings in psig.
g. High-limit setting in psig.
h. Operating-control setting.
i. High-fire set point.
j. Low-fire set point.
k. Voltage at each connection.
l. Amperage for each phase.
m. Draft fan voltage at each connection.
n. Draft fan amperage for each phase.
o. Manifold pressure in psig.

S. Air-to-Air Heat-Recovery Unit Reports:

1. Unit Data:

a. Unit identification.
b. Location.
c. Service.
d. Make and type.
e. Model and serial numbers.

2. Motor Data:

a. Make and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Sheave dimensions, center-to-center, and amount of adjustments in inches.

3. If fans are an integral part of the unit, include the following for each fan:

a. Make and type.
b. Arrangement and size.
c. Sheave make, size in inches, and bore.
d. Sheave dimensions, center-to-center, and amount of adjustments in inches.

4. Test Data (Indicated and Actual Values):

a. Total exhaust airflow rate in cfm.
b. Purge exhaust airflow rate in cfm.
c. Outside airflow rate in cfm.
d. Total exhaust fan static pressure in inches wg.
e. Total outside-air fan static pressure in inches wg.
f. Pressure drop on each side of recovery wheel in inches wg.
g. Exhaust air temperature entering in deg F.
h. Exhaust air temperature leaving in deg F.
i. Outside-air temperature entering in deg F.
j. Outside-air temperature leaving in deg F.
k. Calculate sensible and total heat capacity of each airstream in MBh.

T. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.26 INSPECTIONS

A. Initial Inspection:

1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the Final Report.
2. Randomly check the following for each system:

a. Measure airflow of at least 10 percent of air outlets.
b. Measure water flow of at least 5 percent of terminals.
c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
d. Measure sound levels at two locations.
e. Measure space pressure of at least 10 percent of locations.
f. Verify that balancing devices are marked with final balance position.
g. Note deviations to the Contract Documents in the Final Report.

B. Final Inspection:

1. After initial inspection is complete and evidence by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Architect.
2. TAB firm test and balance engineer shall conduct the inspection in the presence of Architect.
3. Architect shall randomly select measurements documented in the final report to be rechecked. The rechecking shall be limited to either 10 percent of the total measurements recorded, or the extent of measurements that can be accomplished in a normal 8-hour business day.
4. If the rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
6. TAB firm shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes and resubmit the final report.
7. Request a second final inspection. If the second final inspection also fails, Owner shall contract the services of another TAB firm to complete the testing and balancing in

accordance with the Contract Documents and deduct the cost of the services from the final payment.

3.27 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional testing, inspecting, and adjusting during near-peak summer and winter conditions.

END OF SECTION 230593

Construction Documents 6/12/24

SECTION 23 09 00

DIRECT DIGITAL CONTROL SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes control equipment for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-wired controls.

B. Related Sections include the following:

1. Division 23 Section "Meters and Gages for HVAC Piping" for measuring equipment that relates to this Section.

1.3 DEFINITIONS

A. DDC: Direct digital control.

B. I/O: Input/output.

C. LonWorks: A control network technology platform for designing and implementing interoperable control devices and networks.

D. MS/TP: Master slave/token passing.

E. PC: Personal computer.

F. PID: Proportional plus integral plus derivative.

G. RTD: Resistance temperature detector.

1.4 SYSTEM PERFORMANCE

A. Comply with the following performance requirements:

1. Graphic Display: Display graphic with minimum 20 dynamic points with current data within 15 seconds.

2. Graphic Refresh: Update graphic with minimum 20 dynamic points with current data within 15 seconds.

3. Object Command: Reaction time of less than ten seconds between operator command of a binary object and device reaction.

4. Object Scan: Transmit change of state and change of analog values to control units or workstation within ten seconds.

5. Alarm Response Time: Annunciate alarm at workstation within 45 seconds. Multiple workstations must receive alarms within five seconds of each other.

6. Program Execution Frequency: Run capability of applications as often as one minute, but selected consistent with mechanical process under control.

7. Performance: Programmable controllers shall execute DDC PID control loops, and scan and update process values and outputs at least once per 10 seconds.

8. Reporting Accuracy and Stability of Control: Maintain measured variables within tolerances as follows:
   a. Water Temperature: Plus or minus 2 deg F.
   b. Water Flow: Plus or minus 5 percent of full scale.
   c. Water Pressure: Plus or minus 2 percent of full scale.
   d. Space Temperature: Plus or minus 1.5 deg F.
   e. Ducted Air Temperature: Plus or minus 2 deg F.
   f. Outside Air Temperature: Plus or minus 2 deg F.
   g. Dew Point Temperature: Plus or minus 3 deg F.
   h. Temperature Differential: Plus or minus 0.25 deg F.
   i. Relative Humidity: Plus or minus 5 percent.
   j. Airflow (Pressurized Spaces): Plus or minus 3 percent of full scale.
   k. Airflow (Measuring Stations): Plus or minus 5 percent of full scale.
   l. Airflow (Terminal): Plus or minus 10 percent of full scale.
   m. Air Pressure (Space): Plus or minus 0.01-inch wg.
   n. Air Pressure (Ducts): Plus or minus 0.1-inch wg.
   o. Carbon Monoxide: Plus or minus 5 percent of reading.
   p. Carbon Dioxide: Plus or minus 50 ppm.
   q. Electrical: Plus or minus 5 percent of reading.

1.5 SEQUENCE OF OPERATION – See Plans for points list and sequence of operation.

1.6 SUBMITTALS

A. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated. Submittals shall demonstrate compliance with technical requirements by reference to each subsection of the specification. Where a specific item does not comply with the specification requirements, the deviation shall be presented to the Owner and A/E a minimum of 14 working days prior to bid, along with information as to how the intent of the specification requirement is to be satisfied, for approval. It is the Contractor’s responsibility to demonstrate compliance.

1. DDC System Hardware: Bill of materials of equipment indicating quantity, manufacturer, and model number. Include technical data for operator workstation equipment, interface equipment, control units, transducers/transmitters, sensors, actuators, valves, relays/switches, control panels, and operator interface equipment.
2. Control System Software: Include technical data for operating system software, operator interface, color graphics, and other third-party applications.
3. Controlled Systems: Instrumentation list with element name, type of device, manufacturer, model number, and product data. Include written description of sequence of operation including schematic diagram.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Bill of materials of equipment indicating quantity, manufacturer, and model number.
2. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.
3. Wiring Diagrams: Power, signal, and control wiring.
4. Details of control panel faces, including controls, instruments, and labeling.
5. Written description of sequence of operation.
6. Schedule of dampers including size, leakage, and flow characteristics.
7. Schedule of valves including flow characteristics.
8. DDC System Hardware:
    a. Wiring diagrams for control units with termination numbers.
    b. Schematic diagrams and floor plans for field sensors and control hardware.
    c. Schematic diagrams for control, communication, and power wiring, showing trunk data conductors and wiring between operator workstation and control unit locations.
9. Control System Software: List of color graphics indicating monitored systems, data (connected and calculated) point addresses, output schedule, and operator notations.
10. Controlled Systems:
    a. Schematic diagrams of each controlled system with control points labeled and control elements graphically shown, with wiring.
    b. Scaled drawings showing mounting, routing, and wiring of elements including bases and special construction.
    c. Written description of sequence of operation including schematic diagram.
    d. Points list.

C. Data Communications Protocol Certificates: Certify that each proposed DDC system component complies with ASHRAE 135.

D. Data Communications Protocol Certificates: Certify that each proposed DDC system component complies with LonWorks.

E. Software and Firmware Operational Documentation: Include the following:

1. Software operating and upgrade manuals on pdf file on local C:drive.
2. Program Software Backup: On a magnetic media or compact disc or on local computer C:drive, complete with data files.
3. Device address list.
4. Software license required by and installed for DDC workstations and control systems.

F. Qualification Data: The DDC system as specified herein shall be provided in its entirety by the controls contractor. Bids by wholesalers, contractors or franchised dealers or any other firm whose principal business is not that of manufacturing and installing automatic temperature control systems shall not be acceptable. Bids and work must be performed by the manufacturer's local factory office.

G. Operation and Maintenance Data: For HVAC instrumentation and control system to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:

1. Maintenance instructions.
2. Interconnection wiring diagrams with identified and numbered system components and devices.
3. Help function when using building automation software.
4. Final shop drawings as-builts and product data sheets and sequence of operation.
5. Verification records and list of set points.
6. Three copies of O/M shall be supplied and utilized in operator's training.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Automatic control system manufacturer's who is trained and approved for installation of system components required for this Project. At a minimum, three fulltime factory trained and certified servicemen located with twenty five miles of building services shall be employed by controls subcontractor.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined by a testing agency acceptable to authorities having jurisdiction, and marked for intended use. The system shall have UL 916, UL873 or UL 864 listing applicable to the application and installation.

C. Comply with ASHRAE 135 for DDC system components.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to equipment manufacturer.

B. System Software: Update to latest version of software at Project completion.

1.9 COORDINATION

A. Coordinate location of thermostats, humidistats, CO2 sensors, and other exposed control sensors with plans and room details before installation.

B. Coordinate supply of conditioned electrical branch circuits for control units and operator workstation.

C. Coordinate with Division 23 section for "Boilers". It is the intent that the Boiler manufacturer is to provide communications gateway to interface with building automation system. Controls subcontractor is to review the boiler specification and bring to the A/E attention if the boiler specification is not properly coordinated.

D. Coordinate equipment with Division 26 Section "Electrical Power Monitoring and Control" to achieve 120Vac for building automation system. BAS contractor shall provide all 120Vac circuits required for building automation use from any nearest electrical panel available spare circuit. Mark locations on as-built drawings.

E. Coordinate equipment with Division 26 Section "Panelboards" to achieve compatibility with starter coils and annunciation devices.

F. Coordinate equipment with Division 26 Section "Motor-Control Centers" to achieve compatibility with motor starters and annunciation devices.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 CONTROL SYSTEM

A. Manufacturers:

1. Schneider Electric

2. Automated Logic Controls

3. Johnson Controls Inc.

4. Siemens

5. ECS

6. Trane

B. Qualification Data: The DDC system as specified herein shall be provided in its entirety by the controls contractor. Bids by wholesalers, contractors or franchised dealers or any other firm whose principal business is not that of manufacturing and installing automatic temperature control systems shall not be acceptable. Bids and work must be performed by the manufacturer's local factory office.

C. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, and accessories to control mechanical systems. Common industry protocols shall be BacNet over IP, LonTalk for all systems including primary and secondary networks. Ethernet connections to interface with the LAN or WAN.

D. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, accessories, and software connected to distributed controllers operating in multiuser, multitasking environment on token-passing network and programmed to control mechanical systems. An operator workstation permits interface with the network via dynamic color graphics with each mechanical system, building floor plan, and control device depicted by point-and-click graphics.

2.3 DDC EQUIPMENT

A. Operator Workstation: Provide a computer workstation and installed at school system central maintenance office with the minimum performances as required by the BAS manufacturer.

B. Building Control Units: Modular, comprising processor board with programmable, nonvolatile, random-access memory; integral interface equipment; and backup power source.

1. Units monitor or control each I/O point; process information; execute commands from other control units, devices, and operator stations; and download from or upload to operator workstation or diagnostic terminal unit.

2. Stand-alone mode control functions operate regardless of network status. Functions include the following:

a. Global communications.

b. Discrete/digital, analog, and pulse I/O.

c. Monitoring, controlling, or addressing data points.

d. Software applications, scheduling, and alarm processing.

e. Testing and developing control algorithms without disrupting field hardware and controlled environment.

3. Standard Application Programs:

a. Electric Control Programs: Demand limiting, duty cycling, automatic time scheduling, start/stop time optimization, night setback/setup, on-off control with differential sequencing, staggered start, anti short cycling, PID control, DDC with fine tuning, and trend logging.

b. HVAC Control Programs: Optimal run time, supply-air reset, and enthalpy switchover.

c. Chiller Control Programs: Control function of condenser-water reset, chilled-water reset, and equipment sequencing.

d. Programming Application Features: Include trend point; alarm processing and messaging; weekly, monthly, and annual scheduling; energy calculations; run-time totalization; and security access.

e. Remote communications.

f. Maintenance management.

g. Units of Measure: Inch-pound and SI (metric).

4. ASHRAE 135 Compliance: Control units shall use ASHRAE 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.

5. LonWorks or BACnet Compliance: Control units shall use LonTalk or BACnet protocol and communicate using EIA/CEA 709.1 datalink/physical layer protocol.

C. Programmable Direct Digital Control Units: Modular, comprising processor board with electronically programmable, nonvolatile, read-only memory; and backup power source.

1. Units monitor or control each I/O point, process information, and download from or upload to operator workstation or diagnostic terminal unit.

2. Stand-alone mode control functions operate regardless of network status. Functions include the following:

a. Global communications.

b. Discrete/digital, analog, and pulse I/O.

c. Monitoring, controlling, or addressing data points.

3. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.

4. ASHRAE 135 Compliance: Control units shall use ASHRAE 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.

5. LonWorks or BACnet Compliance: Control units shall use LonTalk or BACnet protocol and communicate using EIA/CEA 709.1 datalink/physical layer protocol.

D. I/O Interface: Hardwired inputs and outputs may tie into system through controllers. Protect points so that shorting will cause no damage to controllers.

1. Binary Inputs: Allow monitoring of on-off signals without external power.
2. Pulse Accumulation Inputs: Accept up to 10 pulses per second.
3. Analog Inputs: Allow monitoring of low-voltage (0- to 10-V dc), current (4 to 20 mA), or resistance signals.
4. Binary Outputs: Provide on-off or pulsed low-voltage signal, selectable for normally open or normally closed operation..
5. Analog Outputs: Provide modulating signal, either low voltage (0- to 10-V dc) or current (4 to 20 mA.
6. Tri-State Outputs: Provide two coordinated binary outputs for control of three-point, floating-type electronic actuators.
7. Universal I/Os: Provide software selectable binary or analog outputs.

E. Power Supplies: Transformers with Class 2 current-limiting type or overcurrent protection; limit connected loads to 80 percent of rated capacity..

2.4 WEB BASE OPERATOR INTERFACE

A. System shall include a web-based operator (WEB-OPS) interface to allow user functions to be accomplished from any network connected PC that includes a web browser.

B. Operators shall be able to utilize a browser such as Microsoft Internet Explorer with the appropriate plug-in software.

C. All communications between the web browser and web page server shall be encrypted using 128 bit SSL encryption.

D. The web page server shall be able to be located on the owners Intranet or on the Internet.

E. The system shall have adequate capacity to store and serve up to 450 user defined graphics that each include up to 30 points per graphic.

F. Any unlimited number of users shall be able to access system web pages. Up to 30 users shall be able to use the system simultaneously.

G. Operators shall be required to enter a valid user name and password to access the system. The view of the system provided for the user will be customized based on user identity.

H. Operator security. Each operator shall be able to be assigned a unique user name and password. Users shall be assigned to view, view and edit or administrative capability.

I. The web-based operator interface shall display the same graphics that have been created for any associated Windows-based Operators Workstation. Graphics shall be able to contain both static information such as floor plans and equipment schematics, as well as dynamic information including space temperatures, setpoints, and equipment status information.

J. All dynamic values shall be refreshed with live data upon initial graphic presentation and automatically refreshed every 10 seconds thereafter. The refresh of dynamic data shall not require a refresh of the static information on the graphic.

K. Operators with proper security shall be able to override setpoints and equipment operation.

L. System schedules shall be easily selected for display. Operators with valid security shall be allowed to make changes to schedules including modifications to start and stop times and creating exception days. These changes shall be made graphically within the web browser.

M. A log of system alarms and events shall be able to be viewed from the web browser. Operators with proper security shall be able to acknowledge alarms.

N. System trends shall be able to be selected and viewed. Trends shall be shown graphically with the proper axis scaling automatically selected. Multiple trends shall be able to be viewed at one time.

2.5 UNITARY APPLICATION SPECIFIC AND PROGRAMMABLE CONTROLLERS

A. Unitized, capable of stand-alone operation with sufficient memory to support its operating system, database, and programming requirements, and with sufficient I/O capacity for the application.

1. Configuration: Diagnostic LEDs for power, communication, and processor; wiring termination to terminal strip or card connected with ribbon cable; memory with bios.
2. Operating System: Manage I/O communication to allow distributed controllers to share real and virtual object information and allow central monitoring and alarms.
3. LonWorks Compliance: Communicate using EIA/CEA 709.1 datalink/physical layer protocol using LonTalk protocol.
4. Enclosure: Dustproof rated for operation at 32 to 120 deg F.
5. Enclosure: Waterproof rated for operation at 40 to 120 deg F.

2.6 ELECTRONIC SENSORS

A. Description: Vibration and corrosion resistant; for wall, immersion, or duct mounting as required. Thermistor sensing, RTD and transmitter sensing is acceptable for any application.

B. Fan Coil Unit and Terminal Unit Thermostats and other Thermistor Temperature Sensors (type II) and Transmitters:

1. Manufacturers:
   a. Kele (Room sensor ST-S24-EW-XA).
   b. MAMAC Systems, Inc (Room sensor TE-205-EX-X-2).
   c. Trane (Room sensor BAYSEN074A).
2. Accuracy: Plus or minus 1 deg F at calibration point.
3. Wire: as recommended by building automation system provider.
4. Insertion Elements in Ducts: Single point, length as required by application.
5. Averaging Elements in Ducts: 12 inches.
6. Insertion Elements for Liquids: Brass or stainless-steel socket with minimum insertion length of 2-1/2 inches.
7. Room Sensor: Kele ST-S24-EW-XA. Sensor with lever setpoint adjust, on/override to. Trane BAYSEN074A.
8. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.

C. RTDs and Transmitters:

1. Manufacturers:
   a. Kele.
   b. MAMAC Systems, Inc.

c. Basys.

d. Veris.

e. Trane.

2. Accuracy: Plus or minus 1 deg F at calibration point.

3. Wire: as recommended by building automation system provider.

4. Insertion Elements in Ducts: Single point, length as required by application.

5. Averaging Elements in Ducts: 12 inches.

6. Insertion Elements for Liquids: Brass or stainless-steel socket with minimum insertion length of 2-1/2 inches.

7. Room Sensor: Space sensor located in public area (corridors, lobby, etc) shall be metallic wall plate type 2 thermistor with no logo or adjustment dial. Or sensor with setpoint adjust, on/override to match existing.

8. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.

D. Humidity Sensors: Bulk polymer sensor element.

1. Manufacturers:

a. ACI model A/RH3-D.

b. Vaisala HMD50U.

c. Trane 3% RH series type.

2. Accuracy: 3 percent full range with linear output.

3. Room Sensor Range: 20 to 80 percent relative humidity.

4. Room Sensor Cover Construction: Manufacturer's standard locking covers.

5. Duct Sensor: 20 to 80 percent relative humidity range with element guard and mounting plate.

6. Outside-Air Sensor: 20 to 80 percent relative humidity range with mounting enclosure, suitable for operation at outdoor temperatures of 0 to 120 degrees.

7. Duct and Sensors: With element guard and mounting plate, range of 0 to 100 percent relative humidity.

E. Pressure Transmitters/Transducers:

1. Manufacturers:

a. Kele.

b. General Eastern Instruments.

c. MAMAC Systems, Inc.

d. TCS/Basys Controls.

e. Vaisala.

f. Trane.

2. Static-Pressure Transmitter: Nondirectional sensor with suitable range for expected input, and temperature compensated.

a. Accuracy: 2 percent of full scale with repeatability of 0.5 percent.

b. Output: 4 to 20 mA.

c. Building Static-Pressure Range: 0- to 1-inch wg .

d. Duct Static-Pressure Range: 0- to 5-inch wg.

3. Water Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig operating pressure; linear output 4 to 20 mA.

4. Water Differential-Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig operating pressure and tested to 300-psig; linear output 4 to 20 mA.

5. Differential-Pressure Switch (Air or Water): Snap acting, with pilot-duty rating and with suitable scale range and differential.

6. Pressure Transmitters: Direct acting for gas, liquid, or steam service; range suitable for system; linear output 4 to 20 mA.

2.7 STATUS SENSORS

1. Manufacturers:

a. Trane.

b. Veris.

c. Kele.

B. Status Inputs for Fans: Differential-pressure switch with pilot-duty rating and with adjustable range of 0- to 5-inch wg (0 to 1240 Pa). Or current-sensing fixed- or split-core transformers with self-powered transmitter, adjustable and suitable for 120 percent of rated motor current.

C. Status Inputs for Pumps: Differential-pressure switch with pilot-duty rating and with adjustable pressure-differential range of 8 to 60 psig (55 to 414 kPa), piped across pump.

D. Status Inputs for Electric Motors: Comply with ISA 50.00.01, current-sensing fixed- or split-core transformers with self-powered transmitter, adjustable and suitable for 120 percent of rated motor current.

E. Status of fans, pumps, or motor using current switches: Self-powered, solid-state with adjustable trip current, selected to match current and system output requirements.

F. Water-Flow Switches: Bellows-actuated mercury or snap-acting type with pilot-duty rating, stainless-steel or bronze paddle, with appropriate range and differential adjustment, in NEMA 250, Type 1 enclosure.

1. Manufacturers:

a. JCI.

b. I.T.M. Instruments Inc.

c. Trane.

2.8 CO2 and CO sensors

A. Manufacturers:

1. Telaire.

2. Veris.

3. Kele.

4. Vaisala.
5. Trane.

B. Carbon Dioxide and Carbon Monoxide Sensor and Transmitter: Single detectors using solid-state infrared sensors; suitable over a temperature range of 23 to 130 deg F (minus 5 to plus 55 deg C) and factory calibrated, with continuous or averaged reading, 4- to 20-mA output; for wall mounting or duct mounting as required by application.

2.9 AIR/WATER FLOW MEASURING STATIONS

A. Duct Airflow Station: Combination of air straightener and multiport, self-averaging pitot tube station. Outside air flow station to be provided by RTU equipment manufacturer.

1. Manufacturers:
   a. Air Monitor Corporation.
   b. Ebtron Gold Series.
   c. Trane Traq.
2. Casing: Galvanized-steel frame.
3. Flow Straightener: Aluminum honeycomb, 3/4-inch (20-mm) parallel cell, 3 inches (75 mm) deep.
4. Sensing Manifold: Copper manifold with bullet-nosed static pressure sensors positioned on equal area basis.
5. Factory mounted Traq damper is acceptable.
6. Ebtron thermal disbursement technology type is acceptable.
7. For water flow Onicon F1210 dual turbine flow meter.

2.10 THERMOSTATS

A. Manufacturers:

1. Kele.
2. Trane.
3. JCI.

B. Combination Thermostat and Fan Switches: Line-voltage thermostat with push-button or lever-operated fan switch.

1. Label switches ["FAN ON-OFF"].
2. Mount on single electric switch box.

C. Low-Voltage, On-Off Thermostats: NEMA DC 3, 24-V, bimetal-operated, mercury-switch type, with adjustable or fixed anticipation heater, concealed set-point adjustment, 55 to 85 deg F (13 to 30 deg C) set-point range, and 2 deg F (1 deg C) maximum differential.

D. Line-Voltage, On-Off Thermostats: Bimetal-actuated, open contact or bellows-actuated, enclosed, snap-switch or equivalent solid-state type, with heat anticipator; listed for electrical rating; with concealed set-point adjustment, 55 to 85 deg F (13 to 30 deg C) set-point range, and 2 deg F (1 deg C) maximum differential.

1. Electric Heating Thermostats: Equip with off position on dial wired to break ungrounded conductors.

2. Selector Switch: Integral, manual on-off-auto.

E. Remote-Bulb Thermostats: On-off or modulating type, liquid filled to compensate for changes in ambient temperature; with copper capillary and bulb, unless otherwise indicated.

1. Bulbs in water lines with separate wells of same material as bulb.

2. Bulbs in air ducts with flanges and shields.

3. Averaging Elements: Copper tubing with either single- or multiple-unit elements, extended to cover full width of duct or unit; adequately supported.

4. Scale settings and differential settings are clearly visible and adjustable from front of instrument.

5. On-Off Thermostat: With precision snap switches and with electrical ratings required by application.

6. Modulating Thermostats: Construct so complete potentiometer coil and wiper assembly is removable for inspection or replacement without disturbing calibration of instrument.

F. Fire-Protection Thermostats where shown on plans or points list: Listed and labeled by an NRTL acceptable to authorities having jurisdiction; with fixed or adjustable settings to operate at not less than 75 deg F (24 deg C) above normal maximum operating temperature, and the following:

1. Reset: Manual.

2. Reset: Automatic, with control circuit arranged to require manual reset at central control panel; with pilot light and reset switch on panel labeled to indicate operation.

G. Immersion Thermostat: Remote-bulb or bimetal rod-and-tube type, proportioning action with adjustable throttling range and adjustable set point.

H. Electric, Low-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual-]reset switch that trips if temperature sensed across any 12 inches (300 mm) of bulb length is equal to or below set point.

1. Bulb Length: Minimum 10 feet.

2. Quantity: As required by application.

I. Electric, High-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual- reset switch that trips if temperature sensed across any 12 inches (300 mm) of bulb length is equal to or above set point.

1. Bulb Length: Minimum 10 feet.

2. Quantity: As required by application.

2.11 ACTUATORS

A. Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.

1. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

2. Belimo, Trane or approved equal. Actuator on VAV, FCU, UV, Blower coil terminal unit valves are failed in place floating signal type.

3. Nonspring-Return Motors for Valves Larger Than NPS 2-1/2 (DN 65): Size for running torque of 150 in. x lbf (16.9 N x m) and breakaway torque of 300 in. x lbf (33.9 N x m).

4. Spring-Return Motors for Valves Larger Than NPS 2-1/2 (DN 65): Size for running and breakaway torque of 150 in. x lbf (16.9 N x m).
5. Nonspring-Return Motors for Dampers Larger Than 25 Sq. Ft. (2.3 sq. m): Size for running torque of 150 in. x lbf (16.9 N x m) and breakaway torque of 300 in. x lbf (33.9 N x m).
6. Spring-Return Motors for Dampers Larger Than 25 Sq. Ft. (2.3 sq. m): Size for running and breakaway torque of 150 in. x lbf (16.9 N x m).

B. Electronic Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.

1. Manufacturers:
   a. Belimo Aircontrols (USA), Inc.
   b. Trane.
2. Valves: Size for torque required for valve close off at maximum pump differential pressure.
3. Dampers: Size for running torque calculated as follows:
   a. Parallel-Blade Damper with Edge Seals: 7 inch-lb/sq. ft. (86.8 kg-cm/sq. m) of damper.
   b. Opposed-Blade Damper with Edge Seals: 5 inch-lb/sq. ft. (62 kg-cm/sq. m) of damper.
   c. Parallel-Blade Damper without Edge Seals: 4 inch-lb/sq. ft (49.6 kg-cm/sq. m) of damper.
   d. Opposed-Blade Damper without Edge Seals: 3 inch-lb/sq. ft. (37.2 kg-cm/sq. m) of damper.
   e. Dampers with 2- to 3-Inch wg (500 to 750 Pa) of Pressure Drop or Face Velocities of 1000 to 2500 fpm (5 to 13 m/s): Increase running torque by 1.5.
   f. Dampers with 3- to 4-Inch wg (750 to 1000 Pa) of Pressure Drop or Face Velocities of 2500 to 3000 fpm (13 to 15 m/s): Increase running torque by 2.0.
4. Coupling: V-bolt and V-shaped, toothed cradle.
5. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
6. Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual gear release on nonspring-return actuators.
7. Power Requirements (Two-Position Spring Return): 24 V ac.
8. Power Requirements (Modulating): Maximum 10 VA at 24-V ac or 8 W at 24-V dc.
9. Proportional Signal: 2- to 10-V dc or 4 to 20 mA.
10. Tri-state: Floating signal.
11. Temperature Rating: 40 to 104 deg F (5 to 40 deg C).
12. Run Time: Sized as required for application.

2.12 CONTROL VALVES

A. Manufacturers:

1. Belimo.

2. Trane.
3. JCI.
4. Hays Fluid Controls.

B. Control Valves: Factory fabricated, of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated.

C. Hydronic system globe valves shall have the following characteristics:

1. NPS 2 (DN 50) and Smaller: Class 125 bronze body, bronze trim, rising stem, renewable composition disc, and screwed ends with backseating capacity repackable under pressure.
2. NPS 2-1/2 (DN 65) and Larger: Class 125 iron body, bronze trim, rising stem, plug-type disc, flanged ends, and renewable seat and disc.
3. Internal Construction: Replaceable plugs and stainless-steel or brass seats.
    a. Single-Seated Valves: Cage trim provides seating and guiding surfaces for plug on top and bottom.
4. Sizing: 3 to 5 psi maximum pressure drop at design flow rate or the following:
    a. Two Position: Line size.
    b. Two-Way Modulating: Either the value specified above or twice the load pressure drop, whichever is more.
    c. Three-Way Modulating: Twice the load pressure drop, but not more than value specified above.
5. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.
6. Close-Off (Differential) Pressure Rating: Combination of actuator and trim shall provide minimum close-off pressure rating of 150 percent of total system (pump) head for two-way valves and 100 percent of pressure differential across valve or 100 percent of total system (pump) head.

D. Butterfly Valves: 200-psig (1380-kPa), maximum pressure differential, ASTM A 126 cast-iron or ASTM A 536 ductile-iron body and bonnet, extended neck, stainless-steel stem, field-replaceable EPDM or Buna N sleeve and stem seals.

1. Body Style: Wafer.
2. Disc Type: Nickel-plated ductile iron.
3. Sizing: 1-psig (7-kPa) maximum pressure drop at design flow rate.

E. Terminal Unit Control Valves (VAV, FCU, UV): Brass, bronze, copper, or ductile iron body with threaded, sweat, or flanged connection types. Factory set to maintain constant flow rate with +/- 10 % accuracy over system pressure fluctuations; operating ranges shall fall within 2 – 80 psid. Each valve shall have an identification label, or tag attached by chain, and be factory marked with the manufacturer identification, valve series, and flow rate. Optional readout kit including differential pressure gauge, probes, and carrying case must be made available for purchase from the manufacturer.

1. Operating Pressure: Up to 3” - Minimum 400 PSIG / Above 3” - Minimum 200.
2. Temperature Range: 32° - 225°F.

3. Flow Control Cartridge: Cartridge design shall consist of a tamper proof brass, stainless steel, or elastomeric diaphragm and polyphenylsulfone orifice plate. Manufacturer shall offer optional valve body style that allows for flow control cartridge change-out.

4. Combination Valve Assemblies: Y-Type body to include flow control cartridge, ball valve, pressure/temperature ports, and union end connection.

2.13 DAMPERS

A. Manufacturers:

1. Ruskin.

2. Trane.

3. JCI.

4. United Enertech Corp.

B. Dampers: AMCA-rated, parallel or opposed-blade design; 0.108-inch- (2.8-mm-) minimum thick, galvanized-steel or 0.125-inch- (3.2-mm-) minimum thick, extruded-aluminum frames with holes for duct mounting; damper blades shall not be less than 0.064-inch- (1.6-mm-) thick galvanized steel with maximum blade width of 8 inches (200 mm) and length of 48 inches (1220 mm).

1. Secure blades to 1/2-inch- (13-mm-) diameter, zinc-plated axles using zinc-plated hardware, with nylon blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.

2. Operating Temperature Range: From minus 40 to plus 200 deg F (minus 40 to plus 93 deg C).

3. Edge Seals, Standard Pressure Applications: Closed-cell neoprene.

4. Edge Seals, Low-Leakage Applications: Use inflatable blade edging or replaceable rubber blade seals and spring-loaded stainless-steel side seals, rated for leakage at less than 10 cfm per sq. ft. (50 L/s per sq. m) of damper area, at differential pressure of 4-inch wg (1000 Pa) when damper is held by torque of 50 in. x lbf (5.6 N x m); when tested according to AMCA 500D.

2.14 CONTROL CABLE

A. HVAC control system shall be full DDC. All control wiring in the cable tray shall use purple and yellow colored plenum rated cable. Each color shall be consistent for the entire project and noted on the plans. Blue should be used for the primary network cable and yellow for the secondary network connections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that duct-, pipe-, and equipment-mounted devices are installed before proceeding with installation.

3.2 INSTALLATION

A. Install software in control units and operator workstation(s). Implement all features of programs to specified requirements and as appropriate to sequence of operation.

B. Connect and configure equipment and software to achieve sequence of operation specified.

C. Verify location of thermostats, humidistats, and other exposed control sensors with Drawings and room details before installation. Install devices as shown on drawings above the floor.

1. Install averaging elements in ducts and plenums in crossing or zigzag pattern.

D. Mechanical contractor shall install automatic dampers according to Division 23 Section "Air Duct Accessories."

E. Install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.

F. Install labels and nameplates to identify control components according to Division 23 Section "Identification for HVAC Piping and Equipment."

G. Mechanical contractor shall install hydronic instrument wells, valves, and other accessories according to Division 23 Section "Hydronic Piping."

H. Mechanical contractor shall install steam and condensate instrument wells, valves, and other accessories according to Division 23 Section "Steam and Condensate Heating Piping."

I. Mechanical contractor shall install refrigerant instrument wells, valves, and other accessories according to Division 23 Section "Refrigerant Piping."

J. Mechanical contractor shall install duct volume-control dampers according to Division 23 Sections specifying air ducts.

K. Install electronic and fiber-optic cables according to Division 27 Section "Communications Horizontal Cabling."

3.3 ELECTRICAL WIRING AND CONNECTION INSTALLATION

A. Install raceways, boxes, and cabinets according to Division 26 Section "Raceway and Boxes for Electrical Systems."

B. Install building wire and cable according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

C. Install signal and communication cable for building automation system:

1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed. In mechanical rooms, install wiring in conduit.

2. In concealed accessible area, install cable using plenum rated cable or in cable tray.

3. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.

4. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.

5. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.

6. Install wire and cable with sufficient slack and flexible connections to allow for vibration of piping and equipment.

D. Connect manual-reset limit controls independent of manual-control switch positions.

E. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing.

B. Perform the following field tests and inspections:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
2. Test and adjust controls and safeties.
3. Test each point through its full operating range to verify that safety and operating control set points are as required.
4. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
5. Test each system for compliance with sequence of operation.
6. Test software and hardware interlocks.

C. DDC Verification:

1. Verify that instruments are installed before calibration, testing, and loop checks.
2. Check instruments for proper location and accessibility.
3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.
4. Check instrument tubing for proper fittings, slope, material, and support.
5. Check flow instruments. Inspect tag number and line and bore size, and verify that inlet side is identified and that meters are installed correctly.
6. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.
7. Check temperature instruments and material and length of sensing elements.
8. Check control valves. Verify that they are in correct direction..
9. Check DDC system as follows:
    a. Verify that DDC controller power supply is from emergency power supply, if applicable.
    b. Verify that wires at control panels are tagged with their service designation and approved tagging system.
    c. Verify that spare I/O capacity has been provided.
    d. Verify that main building unit controller(s) are protected from power supply surges.

D. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

3.5 ADJUSTING

A. Calibrating and Adjusting:

1. Verify reading to within accuracy tolerance or use factory calibrated device.
2. Control System Inputs and Outputs:

a. Check analog inputs to verify reading is within accuracy tolerance.

b. Stoke analog output from 0 to 100% span.

c. Check digital inputs using jumper wire.

d. Energize binary output to verify operation.

B. Adjust initial temperature and humidity set points.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC instrumentation and controls. Refer to Division 01 Section "Demonstration and Training."

B. Demonstrate that all controls are installed, adjusted and can perform all functions required. When coordinated with the Energy Manager with an advance two-week notice, this demonstration may be performed in conjunction with instructions to the Owner’s operations personnel.

C. Final Operational Test: Performance test period is not less than 720 consecutive hours until performance standard is met. Operation reliability level of at least 95%. Whenever downtime occurs, correct defects before resuming test. Failure, due to an individual sensor or controller shall not count as system downtime provided that the system records the fault or that the reliability level for all sensors and controllers together is at least 99 percent of the test period.

3.7 TRAINING

A. Refer to 230500

3.8 WARRANTY SERVICE

A. Provide all labor, material and equipment necessary to maintain beneficial performance of the entire control system for a period of one (1) year after acceptance by an authorized representative of the Owner. The controls subcontractor at no charge to the Owner shall promptly correct any defects in workmanship or material during the warranty period. All work shall be accomplished during normal working hours M-F if possible. Critical component failure shall be repaired immediately whether labor involves overtime, weekend, or holidays. Precaution shall be taken to minimize disruption of facility operations.

B. Owner’s involvement in modifications to hardware and/or software or the addition of panels and points shall not void warranty.

END OF SECTION

SECTION 23 21 13

HYDRONIC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Copper tube and fittings.
2. Steel pipe and fittings.
3. Plastic pipe and fittings.
4. Piping joining materials.
5. Transition fittings.
6. Dielectric fittings.

B. Related Sections include the following:

1. Division 23 Section "Hydronic Pumps" for pumps, motors, and accessories for hydronic piping.

1.2 SUBMITTALS

A. Product Data: For each type of product.

B. Qualification Data: For Installer.

C. Welding certificates.

1.3 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installers of Pressure-Sealed Joints: Installers are to be certified by pressure-seal joint manufacturer as having been trained and qualified to join piping with pressure-seal pipe couplings and fittings.

B. All piping shall be manufactured in the USA

C. Steel Support Welding: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.

D. Pipe Welding: Qualify procedures and operators in accordance with ASME Boiler and Pressure Vessel Code: Section IX.

1. Comply with ASME B31.9 for materials, products, and installation.
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

1.4 WARRANTY

A. HDPE Manufacturer's Warranty: Manufacturer agrees to repair or replace PE pipe and fittings that fail in materials or workmanship within 10 years from date of Substantial Completion.

1. Warranty is to cover labor and material costs of repairing and/or replacing defective materials and repairing any incidental damage caused by failure of the piping system due to defects in materials or manufacturing.
2. Warranty is to be in effect only upon submission by Contractor to manufacturer of valid pressure/leak documentation indicating that the system was tested and passed manufacturer's pressure/leak test and any other manufacturer requirements.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Hydronic piping components and installation are to be capable of withstanding the following minimum working pressures and temperatures unless otherwise indicated:

1. Condenser-Water Piping: 150 psig at 150 deg F.
2. Makeup-Water Piping: 80 psig at 150 deg F.
3. Condensate-Drain Piping: 150 deg F.
4. Blowdown-Drain Piping: 200 deg F.
5. Air-Vent Piping: 200 deg F.
6. Safety-Valve-Inlet and -Outlet Piping: Equal to the pressure of the piping system to which it is attached.

2.2 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tube: ASTM B88, Type L.

B. Annealed-Temper Copper Tube: ASTM B88, Type K

C. DWV Copper Tube: ASTM B306, Type DWV.

D. Cast-Copper, Solder-Joint Fittings: ASME B16.18 pressure fittings. Do not use solder joints on pipe sizes greater than NPS 4.

E. Wrought-Copper, Solder-Joint Fittings: ASME B16.22 pressure fittings. Do not use solder joints on pipe sizes greater than NPS 4.

F. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Do not use solder joints on pipe sizes greater than NPS 4.

G. Cast-Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends. Do not use solder joints on pipe sizes greater than NPS 4.

H. Wrought-Copper Unions: ASME B16.22. Do not use solder joints on pipe sizes greater than NPS 4.

I. Copper-Tube, Mechanically Formed Tee Fitting: For forming T-branch on copper water tube.

1. Description: Tee formed in copper tube in accordance with ASTM F2014.

J. Grooved, Mechanical-Joint, Copper Tube Appurtenances:

1. Source Limitations: Obtain grooved mechanical-joint copper tube appurtenances from single manufacturer.
2. Grooved-End Copper Fittings: ASTM B75 copper tube or ASTM B584 bronze castings.
3. Grooved-End-Tube Couplings: To fit copper-tube dimensions; rigid pattern unless otherwise indicated; gasketed fitting EPDM gasket rated for minimum 230 deg F for use with ferrous housing, and steel bolts and nuts; 300 psig minimum CWP pressure rating.

K. Copper-Tube, Pressure-Seal-Joint Fittings - Copper or Bronze:

1. Source Limitations: Obtain copper-tube pressure-seal-joint fittings from single manufacturer.
2. Housing: Copper or bronze.
3. O-Rings and Pipe Stops: EPDM.
4. Tools: Manufacturer's special tools.
5. Minimum 200 psig working pressure rating at 250 deg F.

2.3 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A53/A53M black steel with plain ends; welded and seamless, Grade B, and schedule number as indicated in Part 3,"Piping Applications" Article.

B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250 as indicated in Part 3, "Piping Applications" Article.

C. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300 as indicated in Part 3, "Piping Applications" Article.

D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in Part 3, "Piping Applications" Article.

E. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced as indicated in "Piping Applications" Article.

F. Wrought-Steel Fittings: ASTM A234/A234M; wall thickness to match adjoining pipe.

G. Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

1. Material Group: 1.1.
2. End Connections: Butt welding.
3. Facings: Raised face.

H. Grooved Mechanical-Joint Fittings and Couplings:

1. Source Limitations: Obtain grooved mechanical-joint fittings and couplings from single manufacturer.
2. Joint Fittings: ASTM A536, Grade 65-45-12 ductile iron; ASTM A47/A47M, Grade 32510 malleable iron; ASTM A53/A53M, Type F, E, or S, Grade B fabricated steel; or ASTM A106/A106M, Grade B steel fittings with grooves or shoulders constructed to accept grooved-end couplings; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.
3. Couplings: Ductile- or malleable-iron housing and [**EPDM**] [**or**] [**nitrile**] gasket of central cavity pressure-responsive design; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.

I. Steel Pipe Nipples: ASTM A733, made of same materials and wall thicknesses as pipe in which they are installed.

2.4 PLASTIC PIPE AND FITTINGS

A. HDPE Pipe: ASTM F2619/F2619M.

B. Molded HDPE Fittings: ASTM D2683 or ASTM D3261, ASTM F1055 PE resin, socket, butt-fusion or electro-fusion type, made to match HDPE pipe dimensions and class.

C. Heat-Pump Piping Minimum Working Pressure: 200 psig .

D. Heat-Pump Piping Operating Temperature: Between 23 and 104 deg F.

E. Smoke and Fire Ratings:

1. Where indicated on Drawings that a plenum-rated piping system is required, the pipe is to be wrapped and/or insulated with fiberglass or mineral wool pipe insulation; field installed.

a. The system is to have a flame-spread classification of less than 25 and smoke-developed rating of less than 50.
b. Pipe, wrap, or insulation as a system to comply with the requirements of CAN/ULC-S102.2, ASTM E84, or UL 2846.
c. For insulation required for thermal and condensation conditions, see Section 23 07 19 "HVAC Piping Insulation."

2.5 TRANSITION FITTINGS

A. General Requirements:

1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

C. Plastic-to-Metal Transition Fittings:

1. Source Limitations: Obtain plastic-to-metal transition fittings from single manufacturer.
2. One-piece fitting with one threaded brass or copper insert and one solvent-cement-joint or fusion welded end of material and wall thickness to match plastic pipe material.

D. Plastic-to-Metal Transition Unions:

1. Source Limitations: Obtain plastic-to-metal transition unions from single manufacturer.
2. Brass or copper end and solvent-cement-joint end of union to match pipe in size and material.
3. Description:

a. Brass threaded end.
b. Solvent-cement-joint or fusion-welded plastic end.
c. Rubber O-ring.
d. Union nut.

2.6 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Source Limitations: Obtain dielectric unions from single manufacturer.
2. Description:

a. Standard: ASSE 1079.
b. Pressure Rating: 250 psig minimum at 180 deg F.
c. End Connections: Solder-joint copper alloy and threaded ferrous. Solder joints are not to be used on pipe sizes greater than NPS 4.

C. Dielectric Flanges:

1. Source Limitations: Obtain dielectric flanges from single manufacturer.
2. Description:

a. Standard: ASSE 1079.
b. Factory-fabricated, bolted, companion-flange assembly.
c. Pressure Rating: 150 psig minimum at 180 deg F.
d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:

1. Source Limitations: Obtain dielectric-flange insulating kits from single manufacturer.

2. Description:

   a. Nonconducting materials for field assembly of companion flanges.
   b. Pressure Rating: 150 psig.
   c. Gasket: Neoprene or phenolic.
   d. Bolt Sleeves: Phenolic or polyethylene.
   e. Washers: Phenolic with steel backing washers.

E. Dielectric Nipples:

1. Source Limitations: Obtain dielectric nipples from single manufacturer.
2. Description:

   a. Standard: IAPMO PS 66.
   b. Electroplated steel nipple, complying with ASTM F1545.
   c. Pressure Rating: Minimum 300 psig at 225 deg F.
   d. End Connections: Male threaded or grooved.
   e. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Condenser-Water Piping, Aboveground, NPS 2 (DN 50) and Smaller, to Be Any of the Following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
2. Schedule 40, Grade B, steel pipe; Class 150, malleable-iron, fittings; and threaded or grooved mechanical joints.
3. HDPE plastic piping and fittings with heat fusion joints.

B. Condenser-Water Piping, Aboveground, NPS 2-1/2 (DN 65) and Larger, to Be Any of the Following:

1. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.
2. Schedule 40 Grade B, steel pipe; grooved, mechanical joint coupling and fittings; and grooved mechanical joints.
3. HDPE piping and fittings with heat fusion joints.

C. Makeup-Water Piping Installed Aboveground to Be Any of the Following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
2. HDPE plastic piping and fittings with heat fusion joints.

D. Condensate-Drain Piping Installed Aboveground to Be Any of the Following:

1. Type DWV, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
2. Schedule 40, PVC plastic pipe and fittings and solvent-welded joints.

E. Air-Vent Piping:

1. Inlet: Same as service where installed with metal-to-plastic transition fittings for plastic piping systems, according to piping manufacturer's written instructions.
2. Outlet: Type K, annealed-temper copper tubing with soldered or flared joints.

F. Pressure-Relief-Valve-Inlet and -Outlet Piping for Hot-Water Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed, with metal-to-plastic transition fittings for plastic piping systems, according to piping manufacturer's written instructions.

3.2 INSTALLATION OF PIPING

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Select system components with pressure rating equal to or greater than system operating pressure.

K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

L. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

M. Install piping at a uniform grade of 0.2 percent upward in direction of flow.

N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

O. Install branch connections to mains using mechanically formed tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.

P. Install valves according to Section 23 05 23 "General-Duty Valves for HVAC Piping."

Q. Install air vents and pressure-relief valves in accordance with Section 23 21 16 "Hydronic Piping Specialties."

R. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.

S. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.

T. Install shutoff valve immediately upstream of each dielectric fitting.

U. Comply with requirements in Section 23 05 00 "Common Work Results for HVAC" for installation of expansion loops, expansion joints, anchors, and pipe alignment guides.

V. Comply with requirements in Section 23 05 53 "Identification for HVAC Piping and Equipment" for identifying piping.

W. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 23 05 00 "Common Work Results for HVAC."

X. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 23 05 00 "Common Work Results for HVAC."

Y. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 23 05 00 "Common Work Results for HVAC."

3.3 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Soldered Joints: Apply ASTM B813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints in accordance with ASTM B828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B32.

D. Brazed Joints: Construct joints in accordance with AWS's "Brazing Handbook," "Pipe and Tube" chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8/A5.8M.

E. Threaded Joints: Thread pipe with tapered pipe threads in accordance with ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

F. Welded Joints: Construct joints in accordance with AWS D10.12M/D10.12, using qualified processes and welding operators in accordance with "Quality Assurance" Article.

G. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

H. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings in accordance with the following:

1. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements.
2. PVC Nonpressure Piping: Join in accordance with ASTM D2855.

I. Fiberglass-Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

J. Grooved Joints: Assemble joints with coupling and gasket, lubricant, and bolts. Cut or roll grooves in ends of pipe based on pipe and coupling manufacturer's written instructions for pipe wall thickness. Use grooved-end fittings and rigid, grooved-end-pipe couplings.

K. Mechanically Formed Tee Fittings: Use manufacturer-recommended tools, procedure, and brazed joints.

L. Pressure-Seal Joints: Use manufacturer-recommended tools and procedure. Leave insertion marks on pipe after assembly.

3.4 INSTALLATION OF DIELECTRIC FITTINGS

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 (DN 50) and Smaller: Use dielectric [**nipples**] [**unions**].

C. Dielectric Fittings for NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Use dielectric [**flanges**] [**flange kits**] [**nipples**].

D. Dielectric Fittings for NPS 5 (DN 125) and Larger: Use dielectric flange kits.

3.5 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for seismic-restraint devices specified in Section 23 05 48 "Vibration and Seismic Controls for HVAC."

B. Comply with requirements in Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment" for hangers, supports, and anchor devices.

C. Install hangers for copper tubing and steel piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

D. Install hangers for plastic piping, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

E. Support horizontal piping within 12 inches of each fitting and coupling.

F. Support vertical runs of copper tubing and steel piping to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

G. Support vertical runs of HDPE piping to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.6 TERMINAL EQUIPMENT CONNECTIONS

A. Sizes for supply and return piping connections are to be the same as or larger than equipment connections.

B. Install control valves in accessible locations close to connected equipment.

C. Install bypass piping with globe valve around control valve. If parallel control valves are installed, only one bypass is required.

D. Install ports for pressure gauges and thermometers at coil inlet and outlet connections. Comply with requirements in Section 23 05 00 "Common Work Results for HVAC."

3.7 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Section 23 05 53 "Identification for HVAC Piping and Equipment."

3.8 SYSTEM STARTUP

A. Perform the following before operating the system:

1. Open manual valves fully.
2. Inspect pumps for proper rotation.
3. Set makeup pressure-reducing valves for required system pressure.
4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
5. Set temperature controls so all coils are calling for full flow.

6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
7. Verify lubrication of motors and bearings.

3.9 FIELD QUALITY CONTROL

A. Prepare hydronic piping in accordance with ASME B31.9 and as follows:

1. Leave joints, including welds, uninsulated and exposed for examination during test.
2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure is to be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
5. Install pressure-relief valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on hydronic piping:

1. Use ambient-temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
3. Isolate expansion tanks and determine that hydronic system is full of water.
4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure is not to exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times the "SE" value in Appendix A in ASME B31.9.
5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
6. Prepare written report of testing.

END OF SECTION

Construction Documents 6/12/24

SECTION 23 21 13.33
GROUND-LOOP HEAT-PUMP PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes piping for horizontal and vertical, direct-buried, ground-loop, heat-pump systems that operate between 23 and 104 deg F.

1.3 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:

1. Ground-Loop, Heat-Pump Piping: 160 psig.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Pipe and fittings.
2. Joining method and equipment.

B. Field quality-control test reports.

PART 2 - PRODUCTS

2.1 PIPES AND FITTINGS

A. HDPE Pipe: ASTM D 2239, SDR-11; with PE compound number required to achieve required system working pressure.

1. Molded PE Fittings: ASTM D 2683 or ASTM D 3261, HDPE resin, socket- or butt-fusion type, made to match HDPE pipe dimensions and class.

B. U-Bend Assembly: Factory fabricated with embossed depth stamp every 36 inches from U-bend.

2.2 BOREHOLE BACKFILL

A. Surface Seal: Thermally enhanced bentonite-sand mixture with thermal conductivity greater than 1.20 Btu/h x sq. ft. x deg F.

B. Backfill below Surface Seal: Thermally enhanced bentonite-sand mixture with thermal conductivity greater than 1.20 Btu/h x sq. ft. x deg F.

C. All backfill materials must comply with all NC State regulations, including Aquifer Protection.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, warning tape, and backfilling are specified in Division 31 Section "Earth Moving."

B. Well drilling must be performed by a North Carolina certified well driller.

C. All drilling must comply with all NC State regulations, including Aquifer Protection.

D. The installation of geothermal supply and return piping and well piping must be performed by a North Carolina H-2 licensed contractor and cannot be subcontracted to an unlicensed contractor.

3.2 HORIZONTAL PIPING INSTALLATION

A. Separate trenches by 10 feet minimum, unless otherwise indicated. Remove rocks in trenches that could contact pipe.

B. Backfill to 18 inches above pipe with mud developed from excavated rock-free soil or with sand, pea gravel, or fly ash. Backfill from slurry level to grade with excavated soil, compacting as specified for pipe burial in Division 31 Section "Earth Moving."

C. Extend pipe from trench onto the bottom of the body of water at an elevation that is at least 12 inches below frost line. Seal membrane or impervious liner under the body of water after installing piping.

D. Install PE piping in trenches according to ASTM D 2774 or ASTM F 645.

1. Clean PE pipe and fittings and make heat-fusion joints according to ASTM D 2657. Minimize number of joints.

E. Purge, flush, and pressure test piping before backfilling trenches.

F. Install continuous detectable warning tape for underground piping. Locate tape a minimum of 24 inches below finished grade, directly over piping. Underground warning tapes are specified in Division 31 Section "Earth Moving."

G. Common piping installation requirements are specified in Division 23 Section "Common Work Results for HVAC."

3.3 VERTICAL PIPING INSTALLATION

A. Install HDPE piping in boreholes according to ASTM D 2774 or ASTM F 645.

1. Clean HDPE pipe and fittings and make heat-fusion joints according to ASTM D 2657. Minimize number of joints.

B. Purge, flush, and pressure test piping before backfilling boreholes.

C. After installation of loop pipe in borehole, fill piping loop with water or antifreeze solution, and pump backfill into borehole to discharge at base of borehole.

D. Fill borehole with backfill to a point at least 60 inches below grade and backfill remainder with surface seal material.

E. Extend piping and connect to water-source, ground-loop, heat-pump piping systems at outside face of building wall in locations and pipe sizes indicated.

1. Terminate water-service piping at building wall until building water-source, ground-loop, heat-pump piping systems are installed. Terminate piping with caps. Make connections to building water-source, ground-loop, heat-pump piping systems when those systems are installed.

F. Wall sleeves are specified in Division 23 Section "Common Work Results for HVAC."

G. Mechanical sleeve seals are specified in Division 23 Section "Common Work Results for Plumbing."

3.4 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

3.5 FIELD QUALITY CONTROL

A. Piping Tests: Fill piping 24 hours before testing and apply test pressure to stabilize piping. Use potable water only.

B. Hydrostatic Tests: Test at not less than 1-1/2 times the pipe working-pressure rating allowing for static pressure of borehole depth.

1. Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for 30 minutes. Slowly increase to next test pressure increment and hold for 30 minutes. After testing at maximum test pressure, reduce pressure to 30 psig. Hold for 90 minutes, and measure pressure at 30-minute intervals. Repair leaks and retest until no leaks exist.

C. Prepare reports of testing activity.

END OF SECTION

Construction Documents 6/12/24

SECTION 23 21 23
HYDRONIC PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Close-coupled, in-line centrifugal pumps.
   2. Separately coupled, base-mounted, end-suction centrifugal pumps.
   3. Wet Rotor Pumps (Circulators)

1.3 DEFINITIONS

A. Buna-N: Nitrile rubber.

B. EPT: Ethylene propylene terpolymer.

1.4 SUBMITTALS

A. Product Data: Include certified performance curves and rated capacities, operating characteristics, furnished specialties, final impeller dimensions, and accessories for each type of product indicated. Indicate pump's operating point on curves.

B. Shop Drawings: Show pump layout and connections. Include setting drawings with templates for installing foundation and anchor bolts and other anchorages.

   1. Wiring Diagrams: Power, signal, and control wiring.

C. Operation and Maintenance Data: For pumps to include in emergency, operation, and maintenance manuals.

1.5 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   1. Paco, Inc.
   2. Bell & Gossett; Div. of ITT Industries.
   3. Taco, Inc.
   4. Grundfos

B. Listing of manufacturers name does not guarantee approval. All equipment must meet or exceed quality and capacities of specified equipment. Final approval will be based on equipment submittals. Any manufacturer not listed but wishing to bid this project shall submit a

written request 14 days prior to bid date, prior approval is required for all manufacturers not listed.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain hydronic pumps through one source from a single manufacturer.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of hydronic pumps and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. UL Compliance: Comply with UL 778 for motor-operated water pumps.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Manufacturer's Preparation for Shipping: Clean flanges and exposed machined metal surfaces and treat with anticorrosion compound after assembly and testing. Protect flanges, pipe openings, and nozzles with wooden flange covers or with screwed-in plugs.

B. Store pumps in dry location.

C. Retain protective covers for flanges and protective coatings during storage.

D. Protect bearings and couplings against damage from sand, grit, and other foreign matter.

E. Comply with pump manufacturer's written rigging instructions.

1.8 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

PART 2 - PRODUCTS

2.1 CLOSE-COUPLED, IN-LINE CENTRIFUGAL PUMPS

A. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, close-coupled, in-line pump as defined in HI 1.1-1.2 and HI 1.3; designed for installation with pump and motor shafts mounted horizontally or vertically. Rate pump for 175-psig minimum working pressure and a continuous water temperature of 225 deg F.

B. Pump Construction:

1. Casing: Radially split, cast iron, with threaded gage tappings at inlet and outlet, and threaded flanged connections. Casing shall include vent and drain ports.
2. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. Trim impeller to match specified performance.
3. Pump Shaft: Steel, with copper-alloy shaft sleeve.

4. Mechanical Seal: Carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N bellows and gasket. Include water slinger on shaft between motor and seal.
5. Packing Seal: Stuffing box, with a minimum of four rings of graphite-impregnated braided yarn with bronze lantern ring between center two graphite rings, and bronze packing gland.

C. Premium efficiency motor: Single speed, with grease-lubricated ball bearings, unless otherwise indicated; and rigidly mounted to pump casing. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

D. Capacities and Characteristics: As indicated on the drawings.

2.2 SEPARATELY COUPLED, BASE-MOUNTED, END-SUCTION CENTRIFUGAL PUMPS

A. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, separately coupled, end-suction pump as defined in HI 1.1-1.2 and HI 1.3; designed for base mounting, with pump and motor shafts horizontal. Rate pump for 175-psig minimum working pressure and a continuous water temperature of 225 deg F.

B. Pump Construction:

1. Casing: Radially split, cast iron, with threaded gage tappings at inlet and outlet, drain plug at bottom and air vent at top of volute, and flanged connections.
2. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. Trim impeller to match specified performance.
3. Pump Shaft: Steel, with copper-alloy shaft sleeve.
4. Mechanical Seal: Internally flushed carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N bellows and gasket.
5. Packing Seal: Stuffing box, with a minimum of four rings of graphite-impregnated braided yarn with bronze lantern ring between center two graphite rings, and bronze packing gland.
6. Pump Bearings: Grease-lubricated ball bearings contained in cast-iron housing with grease fittings.

C. Shaft Coupling: Flexible type spacer coupler capable of absorbing torsional vibration. Couplings shall be drop-out type to allow disassembly and removal without removing pump shaft or motor, EPDM coupling sleeve for variable-speed applications. Manufacturer shall align coupler before shipment.

D. Coupling Guard: Dual rated; ANSI B15.1, Section 8; OSHA 1910.219 approved; steel; removable; attached to mounting frame.

E. Mounting Frame: Welded-steel frame and cross members, factory fabricated from ASTM A 36/A 36M channels and angles. Fabricate to mount pump casing, coupling guard, and motor. Bases shall have closed ends and wide open grouting areas.

F. Premium efficiency motor: Single speed, with grease-lubricated ball bearings, unless otherwise indicated; secured to mounting frame, with adjustable alignment. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

G. Capacities and Characteristics: As indicated on the drawings.

2.3 WET-ROTOR PUMPS (CIRCULATORS)

A. Source Limitations: Obtain pumps from single source from single manufacturer.

B. Description: Factory-assembled and -tested, wet-rotor pump. Pump and motor to form an integral unit with bearings lubricated by the pumped liquid.

C. Pump Construction:

1. Body: Cast iron.
2. Impeller: Type 304 stainless steel.
3. Pump Shaft: Type 304 stainless steel.
4. Bearings. Double-sintered carbon.

D. Motor: **Single** speed.

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and use.
2. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230500 "Common Work Results for HVAC."

    a. Efficiency: Premium Efficiency.

3. Integral pump motor variable-speed control.
4. ECM.

2.4 PUMP SPECIALTY FITTINGS

A. Suction Diffuser: Angle pattern, 175-psig pressure rating, cast -iron body and end cap, pump-inlet fitting; with bronze startup and bronze or stainless-steel permanent strainers; bronze or stainless-steel straightening vanes; drain plug; and factory-fabricated support.

B. Triple-Duty Valve: Angle or straight pattern, 175-psig pressure rating, cast-iron body, pump-discharge fitting; with drain plug and bronze-fitted shutoff, balancing, and check valve features. Brass gage ports with integral check valve, and orifice for flow measurement.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine equipment foundations and anchor-bolt locations for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before pump installation.

C. Examine foundations and inertia bases for suitable conditions where pumps are to be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 CONCRETE BASES

A. Install concrete bases of dimensions indicated for pumps and controllers. Refer to Division 23 Section "Common Work Results for HVAC."

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around full perimeter of base.
2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.

B. Cast-in-place concrete materials and placement requirements are specified in Division 03.

3.3 PUMP INSTALLATION

A. Comply with HI 1.4.

B. Install pumps with access for periodic maintenance including removal of motors, impellers, couplings, and accessories.

C. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.

D. Install continuous-thread hanger rods and spring hangers with vertical-limit stop of sufficient size to support pump weight. Vibration isolation devices are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment." Fabricate brackets or supports as required. Hanger and support materials are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

E. Suspend vertically mounted, in-line centrifugal pumps independent of piping. Install pumps with motor and pump shafts vertical. Use continuous-thread hanger rods and spring hangers with vertical-limit stop of sufficient size to support pump weight. Vibration isolation devices are specified in Division 21 Section "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment." Hanger and support materials are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment/Hangers and Supports for HVAC Piping and Equipment."

F. Set base-mounted pumps on concrete foundation. Disconnect coupling before setting. Do not reconnect couplings until alignment procedure is complete.

1. Support pump baseplate on rectangular metal blocks and shims, or on metal wedges with small taper, at points near foundation bolts to provide a gap of 3/4 to 1-1/2 inches between pump base and foundation for grouting.
2. Adjust metal supports or wedges until pump and driver shafts are level. Check coupling faces and suction and discharge flanges of pump to verify that they are level and plumb.

3.4 ALIGNMENT

A. Align pump and motor shafts and piping connections after setting on foundation, grout has been set and foundation bolts have been tightened, and piping connections have been made.

B. Comply with pump and coupling manufacturers' written instructions.

C. Adjust pump and motor shafts for angular and offset alignment by methods specified in HI 1.1-1.5, "Centrifugal Pumps for Nomenclature, Definitions, Application and Operation, HI 2.1-2.5, " Vertical Pumps for Nomenclature, Definitions, Application and Operation."

D. After alignment is correct, tighten foundation bolts evenly but not too firmly. Completely fill baseplate with nonshrink, nonmetallic grout while metal blocks and shims or wedges are in place. After grout has cured, fully tighten foundation bolts.

3.5 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to machine to allow service and maintenance.

C. Connect piping to pumps. Install valves that are same size as piping connected to pumps.

D. Install suction and discharge pipe sizes equal to or greater than diameter of pump nozzles.

E. Install check valve and throttling or triple-duty valve on discharge side of pumps as indicated on the drtawings.

F. Install Y-type strainer or suction diffuser and shutoff valve on suction side of pumps as indicated on the drawings.

G. Install flexible connectors on suction and discharge sides of base-mounted pumps between pump casing and valves.

H. Install pressure gages on pump suction and discharge, at integral pressure-gage tapping, or install single gage with multiple input selector valve.

I. Install check valve and gate or ball valve on each condensate pump unit discharge.

J. Install electrical connections for power, controls, and devices.

K. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

L. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.6 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Check piping connections for tightness.
3. Clean strainers on suction piping.
4. Perform the following startup checks for each pump before starting:

    a. Verify bearing lubrication.

b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
c. Verify that pump is rotating in the correct direction.

5. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
6. Start motor.
7. Open discharge valve slowly.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain hydronic pumps. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION

Construction Documents 6/12/24

SECTION 232300

REFRIGERANT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes refrigerant piping used for air-conditioning applications.

1.2 PERFORMANCE REQUIREMENTS

A. Line Test Pressure for Refrigerant R-407C:

1. Suction Lines for Air-Conditioning Applications: 230 psig.
2. Suction Lines for Heat-Pump Applications: 380 psig.
3. Hot-Gas and Liquid Lines: 380 psig.

B. Line Test Pressure for Refrigerant R-410A:

1. Suction Lines for Air-Conditioning Applications: 300 psig.
2. Suction Lines for Heat-Pump Applications: 535 psig.
3. Hot-Gas and Liquid Lines: 535 psig.

1.3 QUALITY ASSURANCE

A. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."

B. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.4 PRODUCT STORAGE AND HANDLING

A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B 88, Type K or L

B. Wrought-Copper Fittings: ASME B16.22.

C. Wrought-Copper Unions: ASME B16.22.

D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.

E. Brazing Filler Metals: AWS A5.8.

F. Flexible Connectors:

1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
2. End Connections: Socket ends.
3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch- long assembly.
4. Pressure Rating: Factory test at minimum 500 psig.
5. Maximum Operating Temperature: 250 deg F.

2.2 VALVES AND SPECIALTIES

A. Diaphragm Packless Valves:

1. Body and Bonnet: Forged brass or cast bronze; globe design with straight-through or angle pattern.
2. Diaphragm: Phosphor bronze and stainless steel with stainless-steel spring.
3. Operator: Rising stem and hand wheel.
4. Seat: Nylon.
5. End Connections: Socket, union, or flanged.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 275 deg F.

B. Packed-Angle Valves:

1. Body and Bonnet: Forged brass or cast bronze.
2. Packing: Molded stem, back seating, and replaceable under pressure.
3. Operator: Rising stem.
4. Seat: Nonrotating, self-aligning polytetrafluoroethylene.
5. Seal Cap: Forged-brass or valox hex cap.
6. End Connections: Socket, union, threaded, or flanged.
7. Working Pressure Rating: 500 psig.
8. Maximum Operating Temperature: 275 deg F.

C. Check Valves:

1. Body: Ductile iron, forged brass, or cast bronze; globe pattern.
2. Bonnet: Bolted ductile iron, forged brass, or cast bronze; or brass hex plug.
3. Piston: Removable polytetrafluoroethylene seat.
4. Closing Spring: Stainless steel.
5. Manual Opening Stem: Seal cap, plated-steel stem, and graphite seal.
6. End Connections: Socket, union, threaded, or flanged.
7. Maximum Opening Pressure: 0.50 psig.
8. Working Pressure Rating: 500 psig.
9. Maximum Operating Temperature: 275 deg F.

D. Service Valves:

1. Body: Forged brass with brass cap including key end to remove core.
2. Core: Removable ball-type check valve with stainless-steel spring.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Copper spring.
5. Working Pressure Rating: 500 psig.

E. Solenoid Valves: Comply with ARI 760 and UL 429; listed and labeled by an NRTL.

1. Body and Bonnet: Plated steel.
2. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Threaded.
5. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter, and 24 V ac coil.
6. Working Pressure Rating: 400 psig.
7. Maximum Operating Temperature: 240 deg F.
8. Manual operator.

F. Safety Relief Valves: Comply with ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.

1. Body and Bonnet: Ductile iron and steel, with neoprene O-ring seal.
2. Piston, Closing Spring, and Seat Insert: Stainless steel.
3. Seat Disc: Polytetrafluoroethylene.
4. End Connections: Threaded.
5. Working Pressure Rating: 400 psig.
6. Maximum Operating Temperature: 240 deg F.

G. Thermostatic Expansion Valves: Comply with ARI 750.

1. Body, Bonnet, and Seal Cap: Forged brass or steel.
2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
3. Packing and Gaskets: Non-asbestos.
4. Capillary and Bulb: Copper tubing filled with refrigerant charge.
5. Suction Temperature: 40 deg .
6. Superheat: Adjustable.
7. Reverse-flow option (for heat-pump applications).
8. End Connections: Socket, flare, or threaded union.
9. Working Pressure Rating: 450 psig

H. Straight-Type Strainers:

1. Body: Welded steel with corrosion-resistant coating.
2. Screen: 100-mesh stainless steel.
3. End Connections: Socket or flare.
4. Working Pressure Rating: 500 psig.
5. Maximum Operating Temperature: 275 deg F.

I. Angle-Type Strainers:

1. Body: Forged brass or cast bronze.
2. Drain Plug: Brass hex plug.
3. Screen: 100-mesh monel.
4. End Connections: Socket or flare.
5. Working Pressure Rating: 500 psig.
6. Maximum Operating Temperature: 275 deg F.

J. Moisture/Liquid Indicators:

1. Body: Forged brass.
2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
3. Indicator: Color coded to show moisture content in ppm.
4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
5. End Connections: Socket or flare.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 240 deg F.

K. Replaceable-Core Filter Dryers: Comply with ARI 730.

1. Body and Cover: Painted-steel shell with ductile-iron cover, stainless-steel screws, and neoprene gaskets.
2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
3. Desiccant Media: Activated charcoal.
4. Designed for reverse flow (for heat-pump applications).
5. End Connections: Socket.
6. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
7. Maximum Pressure Loss: 2 psig.
8. Rated Flow: as indicated on the drawings.
9. Working Pressure Rating: 500 psig.
10. Maximum Operating Temperature: 240 deg F.

L. Permanent Filter Dryers: Comply with ARI 730.

1. Body and Cover: Painted-steel shell.
2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
3. Desiccant Media: Activated charcoal.
4. Designed for reverse flow (for heat-pump applications).
5. End Connections: Socket.
6. Access Ports: NPS ¼ connections at entering and leaving sides for pressure differential measurement.
7. Maximum Pressure Loss: 2 psig.
8. Rated Flow: tons as indicated on the drawings
9. Working Pressure Rating: 500 psig.
10. Maximum Operating Temperature: 240 deg F.

M. Liquid Accumulators: Comply with ARI 495.

1. Body: Welded steel with corrosion-resistant coating.
2. End Connections: Socket or threaded.

3. Working Pressure Rating: 500 psig.
4. Maximum Operating Temperature: 275 deg F.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Suction Lines NPS 1-1/2 and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed joints.

B. Suction Lines NPS 4 and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

C. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed or soldered joints.

D. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with soldered joints.

E. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications:

1. NPS 1-1/2 and Smaller: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed or soldered joints.
2. NPS 1-1/2 and Smaller: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.
3. NPS 2 to NPS 3: Copper, Type K, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.
4. NPS 4: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with soldered joints.

F. Safety-Relief-Valve Discharge Piping: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with soldered joints.

G. Safety-Relief-Valve Discharge Piping:

1. NPS 1-1/2 and Smaller: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed or soldered joints.
2. NPS 1-1/2 and Smaller: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with brazed joints.
3. NPS 2 to NPS 3: Copper, Type K, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.
4. NPS 4: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with soldered joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

A. Install diaphragm packless valves in suction and discharge lines of compressor.

B. Install service valves for gage taps at strainers if they are not an integral part of strainers.

C. Install a check valve at the compressor discharge and a liquid accumulator at the compressor suction connection.

D. Except as otherwise indicated, install diaphragm packless valves on inlet and outlet side of filter dryers.

E. Install a full-sized, three-valve bypass around filter dryers.

F. Install solenoid valves upstream from each expansion valve. Install solenoid valves in horizontal lines with coil at top.

G. Install thermostatic expansion valves as close as possible to distributors on evaporators.

1. Install valve so diaphragm case is warmer than bulb.
2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.

H. Install safety relief valves where required by ASME Boiler and Pressure Vessel Code. Pipe safety-relief-valve discharge line to outside according to ASHRAE 15.

I. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.

J. Install strainers upstream from and adjacent to the following unless they are furnished as an integral assembly for device being protected:

1. Solenoid valves.
2. Thermostatic expansion valves.
3. Compressor.

K. Install filter dryers in liquid line between compressor and thermostatic expansion valve.

L. Install flexible connectors at compressors.

3.3 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

B. Install refrigerant piping in accordance with the equipment manufacturer’s recommendations.

C. Install refrigerant piping according to ASHRAE 15.

D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

G. Install piping adjacent to machines to allow service and maintenance.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Select system components with pressure rating equal to or greater than system operating pressure.

K. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

L. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Division 08 Section "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.

M. Install refrigerant piping in protective conduit where installed belowground.

N. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

O. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Install traps and double risers to entrain oil in vertical runs.
4. Liquid lines may be installed level.

P. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

Q. Install pipe sleeves at penetrations in exterior walls and floor assemblies.

R. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

S. Install sleeves through floors, walls, or ceilings, sized to permit installation of full-thickness insulation.

3.4 PIPE JOINT CONSTRUCTION

A. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."

B. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."

1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.
2. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.

3.5 HANGERS AND SUPPORTS

A. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

B. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:

1. NPS 1/2: Maximum span, 60 inches minimum rod size, 1/4 inch
2. NPS 5/8 Maximum span, 60 inches minimum rod size, 1/4 inch
3. NPS 1 Maximum span, 72 inches minimum rod size, 1/4 inch
4. NPS 1-1/4 Maximum span, 96 inches minimum rod size, 3/8 inch
5. NPS 1-1/2 Maximum span, 96 inches minimum rod size, 3/8 inch
6. NPS 2 Maximum span, 96 inches minimum rod size, 3/8 inch
7. NPS 2-1/2 Maximum span, 108 inches minimum rod size, 3/8 inch
8. NPS 3 Maximum span, 10 feet minimum rod size, 3/8 inch
9. NPS 4 Maximum span, 12 feet minimum rod size, 1/2 inch

C. Support multifloor vertical runs at least at each floor.

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. Comply with ASME B31.5, Chapter VI.
2. Test refrigerant piping and specialties. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.

a. Fill system with nitrogen to the required test pressure.
b. System shall maintain test pressure at the manifold gage throughout duration of test.
c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

3.7 SYSTEM CHARGING

A. Charge system using the following procedures:

1. Install core in filter dryers after leak test but before evacuation.
2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
4. Charge system with a new filter-dryer core in charging line.

3.8 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Adjust set-point temperature of air-conditioning controllers to the system design temperature.

D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:
1. Verify that compressor oil level is correct.
2. Open compressor suction and discharge valves.
3. Open refrigerant valves except bypass valves that are used for other purposes.
4. Check open compressor-motor alignment and verify lubrication for motors and bearings.

E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION 232300

Construction Documents 6/12/24

SECTION 233113

METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Single-wall round ducts and fittings.
3. Double-wall round ducts and fittings.
4. Sheet metal materials.
5. Duct liner.
6. Sealants and gaskets.
7. Hangers and supports.

B. Related Sections:

1. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports and seismic restraints shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."

1. Seismic Hazard Level A: Seismic force to weight ratio, 0.48.
2. Seismic Hazard Level B: Seismic force to weight ratio, 0.30.
3. Seismic Hazard Level C: Seismic force to weight ratio, 0.15.

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2007.

1.4 SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.
3. Seismic-restraint devices.

B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment, seismic restraints, and vibration isolation.

C. Delegated-Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.
5. Design Calculations: Calculations, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation for selecting hangers and supports and seismic restraints.

D. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Suspended ceiling components.
3. Structural members to which duct will be attached.
4. Size and location of initial access modules for acoustical tile.
5. Penetrations of smoke barriers and fire-rated construction.
6. Items penetrating finished ceiling including the following:

a. Lighting fixtures.
b. Air outlets and inlets.
c. Speakers.
d. Sprinklers.
e. Access panels.
f. Perimeter moldings.

E. Welding certificates.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2007, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."

D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2007, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 2, "Fittings and Other Construction," for static-pressure class, applicable

sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Lindab Inc.
    b. McGill AirFlow LLC.
    c. SEMCO Incorporated.
    d. Sheet Metal Connectors, Inc.
    e. Spiral Manufacturing Co., Inc.
    f. Hamlin Sheet Metal
    g. Turn Key Duct Systems

B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).

C. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints - Round Duct," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

D. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Seams - Round Duct and Fittings," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.

E. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 DOUBLE-WALL ROUND DUCTS AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Lindab Inc.
2. McGill AirFlow LLC.
3. SEMCO Incorporated.
4. Sheet Metal Connectors, Inc.

B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension) of the inner duct.

C. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on static-pressure class unless otherwise indicated.

1. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints - Round Duct," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

    a. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

2. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Seams - Round Duct and Fittings," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

    a. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
    b. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.

3. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Inner Duct: Minimum 0.028-inch perforated galvanized sheet steel having 3/32-inch- diameter perforations, with overall open area of 23 percent.

E. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
3. Coat insulation with antimicrobial coating.
4. Cover insulation with polyester film complying with UL 181, Class 1.

F. Interstitial Insulation: Flexible elastomeric duct liner complying with ASTM C 534, Type II for sheet materials, and with NFPA 90A or NFPA 90B.

1. Maximum Thermal Conductivity: 0.25 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

2.4 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G60.
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.

D. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.

E. Aluminum Sheets: Comply with ASTM B 209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

F. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.5 DUCT LINER

A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. CertainTeed Corporation; Insulation Group.
    b. Johns Manville.
    c. Knauf Insulation.
    d. Owens Corning.

3. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
4. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.

    a. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Flexible Elastomeric Duct Liner: Preformed, cellular, closed-cell, sheet materials complying with ASTM C 534, Type II, Grade 1; and with NFPA 90A or NFPA 90B.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. Aeroflex USA Inc.
    b. Armacell LLC.
    c. K-Flex USA.

2. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
3. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.

    a. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Insulation Pins and Washers:

1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick galvanized steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

D. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-19, "Flexible Duct Liner Installation."

1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
3. Butt transverse joints without gaps, and coat joint with adhesive.
4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.
7. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

    a. Fan discharges.
    b. Intervals of lined duct preceding unlined duct.
    c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.

9. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.6 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Tape Width: 4 inches.
3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.
6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to plus 200 deg F.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
10. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Solvent-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Base: Synthetic rubber resin.
3. Solvent: Toluene and heptane.
4. Solids Content: Minimum 60 percent.
5. Shore A Hardness: Minimum 60.
6. Water resistant.
7. Mold and mildew resistant.
8. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
9. VOC: Maximum 395 g/L.
10. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
11. Service: Indoor or outdoor.
12. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

E. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

F. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

G. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.7 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 ADDITIONAL INSTALLATION REQUIREMENTS FOR COMMERCIAL KITCHEN HOOD EXHAUST DUCT

A. Install commercial kitchen hood exhaust ducts without dips and traps that may hold grease, and sloped a minimum of 2 percent to drain grease back to the hood.

B. Install fire-rated access panel assemblies at each change in direction and at maximum intervals of 20 feet in horizontal ducts, and at every floor for vertical ducts, or as indicated on Drawings. Locate access panel on top or sides of duct a minimum of 1-1/2 inches from bottom of duct.

C. Do not penetrate fire-rated assemblies except as allowed by applicable building codes and authorities having jurisdiction.

3.4 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Outdoor, Supply-Air Ducts: Seal Class A.
3. Outdoor, Exhaust Ducts: Seal Class C.
4. Outdoor, Return-Air Ducts: Seal Class C.
5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than2-Inch wg: Seal Class A.
7. Unconditioned Space, Exhaust Ducts: Seal Class C.
8. Unconditioned Space, Return-Air Ducts: Seal Class B.
9. Conditioned Space, Supply-Air Ducts in Pressure Classes2-Inch wg and Lower: Seal Class C.
10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
11. Conditioned Space, Exhaust Ducts: Seal Class B.
12. Conditioned Space, Return-Air Ducts: Seal Class C.

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.6 SEISMIC-RESTRAINT-DEVICE INSTALLATION

A. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes. Comply with SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."

1. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
2. Brace a change of direction longer than 12 feet.

B. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install cable restraints on ducts that are suspended with vibration isolators.

E. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction.

F. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to structure, to flanges of beams, to upper truss chords of bar joists, or to concrete members.

G. Drilling for and Setting Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcement or embedded items during drilling. Notify the Architect if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Set anchors to manufacturer's recommended torque, using a torque wrench.
5. Install zinc-coated steel anchors for interior applications and stainless-steel anchors for applications exposed to weather.

3.7 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.8 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 09 painting Sections.

3.9 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Leakage Tests:
1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
2. Test the following systems:
   a. All medium pressure supply mains from built-up Air Handling Units to the terminal box connections.
   b. All concealed low pressure supply mains from built up Air Handing Units.
   c. Low pressure supply ducts (single zone units and supply ductwork downstream of terminal boxes): Test representative duct sections**,** totaling no less than 10 percent of total installed duct area for each designated pressure class.
3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
4. Test for leaks before applying external insulation.
5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
6. Give seven days' advance notice for testing.

C. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.
2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."

   a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

D. Duct system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.10 DUCT CLEANING

A. Clean new duct system(s) before testing, adjusting, and balancing.

B. Use service openings for entry and inspection.

1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Division 23 Section "Air Duct Accessories" for access panels and doors.
2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.

6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.11 START UP

A. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

3.12 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel unless noted otherwise.

B. Supply Ducts:

1. Ducts Connected to Indoor Units, Packaged Heat Pumps, and Downstream of Terminal Boxes:

    a. Pressure Class: Positive 2-inch wg.
    b. Minimum SMACNA Seal Class: A.
    c. SMACNA Leakage Class for Rectangular: Per current SMACNA standards based on specified pressure class.
    d. SMACNA Leakage Class for Round and Flat Oval: Per current SMACNA standards based on specified pressure class.

2. Ducts Connected to Equipment Not Listed Above:

    a. Pressure Class: Positive 3-inch wg.
    b. Minimum SMACNA Seal Class: A.
    c. SMACNA Leakage Class for Rectangular: Per current SMACNA standards based on specified pressure class.
    d. SMACNA Leakage Class for Round and Flat Oval: Per current SMACNA standards based on specified pressure class.

C. Return Ducts:

1. Ducts Connected to Indoor Units and Packaged Heat Pumps:

    a. Pressure Class: Positive or negative 2-inch wg.
    b. Minimum SMACNA Seal Class: A.
    c. SMACNA Leakage Class for Rectangular: Per current SMACNA standards based on specified pressure class.
    d. SMACNA Leakage Class for Round and Flat Oval: Per current SMACNA standards based on specified pressure class.

2. Ducts Connected to Equipment Not Listed Above:

    a. Pressure Class: Positive or negative 3-inch wg.
    b. Minimum SMACNA Seal Class: A.

c. SMACNA Leakage Class for Rectangular: Per current SMACNA standards based on specified pressure class.
d. SMACNA Leakage Class for Round and Flat Oval: Per current SMACNA standards based on specified pressure class.

D. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:

a. Pressure Class: Negative 2-inch wg.
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: Per current SMACNA standards based on specified pressure class.
d. SMACNA Leakage Class for Round and Flat Oval: Per current SMACNA standards based on specified pressure class.

2. Ducts Connected to Commercial Kitchen Hoods: Comply with NFPA 96.

a. Exposed to View: Type 304, stainless-steel sheet, No. 4 finish.
b. Concealed: Carbon-steel sheet.
c. Welded seams and joints.
d. Pressure Class: Positive or negative 3-inch wg.
e. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
f. SMACNA Leakage Class: Per current SMACNA standards based on specified pressure class.

3. Ducts Connected to Dishwasher Hoods:

a. Type 304, stainless-steel sheet.
b. Exposed to View: No. 4 finish.
c. Concealed: No. 2D finish.
d. Welded seams and flanged joints with watertight EPDM gaskets.
e. Pressure Class: Positive or negative 2-inch wg.
f. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
g. SMACNA Leakage Class: Per current SMACNA standards based on specified pressure class.

4. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive or negative 3-inch wg.
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: Per current SMACNA standards based on specified pressure class
d. SMACNA Leakage Class for Round and Flat Oval: Per current SMACNA standards based on specified pressure class.

E. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:

1. Ducts Connected to Indoor Units or Packaged Heat Pumps:

a. Pressure Class: Positive or negative 2-inch wg.

b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: Per current SMACNA standards based on specified pressure class.
d. SMACNA Leakage Class for Round and Flat Oval: Per current SMACNA standards based on specified pressure class.

2. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive or negative 2-inch wg.
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: Per current SMACNA standards based on specified pressure class.
d. SMACNA Leakage Class for Round and Flat Oval: Per current SMACNA standards based on specified pressure class.

F. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel.

2. Stainless-Steel Ducts:

a. Exposed to Airstream: Match duct material.
b. Not Exposed to Airstream: Match duct material.

3. Aluminum Ducts: Aluminum.

G. Double-Wall Duct Interstitial Insulation:

1. Supply Air Ducts: 1 inch thick.
2. Return Air Ducts: 1 inch thick.

H. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Elbows."

a. Velocity 1000 fpm or Lower:

1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
2) Mitered Type RE 4 without vanes.

b. Velocity 1000 to 1500 fpm:

1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."

c. Velocity 1500 fpm or Higher:

1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."

2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Elbows."

a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."

3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-3, "Round Duct Elbows."

a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
4) Radius-to Diameter Ratio: 1.5.

b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.

I. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-6, "Branch Connections."

a. Rectangular Main to Rectangular Branch: 45-degree entry.
b. Rectangular Main to Round Branch: Spin in.

2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees." Saddle taps are permitted in existing duct.

a. Velocity 1000 fpm or Lower: 90-degree tap.
b. Velocity 1000 to 1500 fpm: Conical tap.
c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION 233113

SECTION 23 31 16

NONMETAL DUCTS

PART 1-GENERAL

1.01 DESCRIPTION OF WORK:

A. Extent of non-metal ductwork is indicated on drawings and by requirements of this section.
B. Types of non-metal ductwork required for this project include the following:
   1. Fabric Air Dispersion Products.

1.02 QUALITY ASSURANCE:

A. Building Codes and Standards:
   1. Product must be Classified by Underwriter's Laboratories in accordance with the 25/50 flame spread / smoke developed requirements of NFPA 90-A and are also classified in accordance with ICC Evaluation Service AC167 and UL 2518.. Product must meet UL-C (Canada), BS 5867, part 2, 1980 and GB8624-2006 B-s1, d0, t1 level.
   2. All product sections must be labeled with the logo and classification marking of Underwriter's Laboratories.

B. Design & Quality Control
   1. Manufacturer must have documented design support information including duct sizing, vent and orifice location, vent and orifice sizing, length, and suspension. Parameters for design, including maximum air temperature, velocity, pressure and fabric permeability, shall be considered and documented.

1.03 SUBMITTALS:

A. Product Data: Submit manufacturer's specifications on materials and manufactured products used for work of this section.

B. Building Code Data: Submit UL file number under which product is Classified by Underwriter's Laboratories NFPA 90, ICC AC167 and UL 2518.

1.04 WARRANTY

A. Manufacturer must provide a 5 Year Product Warranty for products supplied for the fabric portion of this system as well as a Design and Performance Warranty.

1.05 DELIVERY, STORAGE AND HANDLING:

A. Protect fabric air dispersion systems from damage during shipping, storage and handling.

B. Where possible, store products inside and protect from weather. Where necessary to store outside, store above grade and enclose with a vented waterproof wrapping.

PART 2 – PRODUCTS

2.01 MANUFACTURERS:

Subject to compliance with requirements, choose one of the following:

A. DuctSox® Corporation
   Phone: (866) DUCTSOX or (563) 589-2777
   FAX: (866) 398-1646 or (563) 589-2754
   www.DuctSox.com
B. Airmax International, Inc.
C. Fabric Duct Systems, Inc.
D. KE Fibertec.
E. Prihoda.
F. NanoSox

2.02 FABRIC AIR DISPERSION SYSTEM:

A. Verona Fabric: Air diffusers shall be constructed of a woven fire retardant fabric complying with the following physical characteristics:
   1. Fabric Construction: 100% Flame Retardant
   2. Weight: 6.2 oz. /yd^2 per ASTM D3776
   3. Color: (MUST SPECIFY- red, white, blue, green, gray, tan or black)
   4. Fabric Porosity: 2 (+2/-1) cfm/ft^2 per ASTM D737, Frazier. Custom Porosity 6, 13 & 29 CFM cfm/ft^2 available.
   5. Temperature Range: 0 degrees F to 180 degrees F
   6. Fire Retardancy: Classified by Underwriters Laboratories in accordance with the requirements of NFPA 90-A and AC-167 (noted above).

B. SYSTEMS FABRICATION REQUIREMENTS:
   1. Air dispersion accomplished by linear vent and permeable fabric. Linear vents must be sized in 1 CFM per linear foot increments (based on .5" SP), starting a 1 CFM through 90 CFM per linear foot. Linear vent is to consist of an array of open orifices rather than a mesh style vent to reduce maintenance requirements of mesh style vents. Linear vents should also be designed to minimize dusting on fabric surface.
   2. Size of and location of linear vents to be specified and approved by manufacturer.
   3. Inlet connection to metal duct via fabric draw band with anchor patches as supplied by manufacturer. Anchor patches to be secured to metal duct via zip screw fastener – supplied by contractor.
   4. Inlet connection includes zipper for easy removal / maintenance.
   5. Lengths to include required zippers as specified by manufacturer.
   6. System to include Adjustable Flow Devices to balance turbulence, airflow and distribution as needed. Flow restriction device shall include ability to adjust the airflow resistance from 0.06 – 0.60 in w.g. static pressure.
   7. Fabric system shall include connectors to accommodate suspension system listed below.
   8. Any deviation from a straight run shall be made using a gored elbow or an efficiency tee. Normal 90 degree elbows are 5 gores and the radius of the elbow is 1.5 times the diameter of the DuctSox.

C. DESIGN PARAMETERS:
   1. Fabric air diffusers shall be designed from 0.25" water gage minimum to 3.0" maximum, with 0.5" as the standard.
   2. Fabric air diffusers shall be limited to design temperatures between 0 degrees F and 180 degrees F (-17.8 degrees C and 82 degrees C).

3. Design CFM, static pressure and diffuser length shall be designed or approved by the manufacturer.
4. Do not use fabric diffusers in concealed locations.
5. Use fabric diffusers only for positive pressure air distribution components of the mechanical ventilation system.

D. SUSPENSION HARDWARE:
   1. One row suspension
      a. U-Track suspension hardware to include 8’ sections of aluminum track, aluminum splice connectors, track endcaps and vertical cable support kits – consisting of a length of cable with cable connectors. Radius aluminum track must be included for all horizontal/flat radius sections.
         1. U-Track suspension options
            a. Galvanized steel cable
            b. Stainless steel cable
         2. Support lengths available in 5’(standard), 10’, 15’, & 30’

PART 3 – INSTALLATION

3.01 INSTALLATION OF FABRIC AIR DISPERSION SYSTEM:

A. Install chosen suspension system in accordance with the requirements of the manufacturer. Instructions for installation shall be provided by the manufacturer with product.

3.02 CLEANING AND PROTECTION:

A. Clean air handling unit and ductwork prior to the DuctSox system unit-by-unit as it is installed. Clean external surfaces of foreign substance which may cause corrosive deterioration of facing.

B. Temporary Closure: At ends of ducts which are not connected to equipment or distribution devices at time of ductwork installation, cover with polyethylene film or other covering which will keep the system clean until installation is completed.

C. If DuctSox systems become soiled during installation, they should be removed and cleaned following the manufacturers standard terms of laundry.

END OF SECTION

Construction Documents 6/12/24

SECTION 233300

AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Backdraft and pressure relief dampers.
2. Barometric relief dampers.
3. Manual volume dampers.
4. Control dampers.
5. Fire dampers.
6. Ceiling dampers.
7. Smoke dampers.
8. Combination fire and smoke dampers.
9. Corridor dampers.
10. Flange connectors.
11. Duct silencers.
12. Turning vanes.
13. Remote damper operators.
14. Duct-mounted access doors.
15. Flexible connectors.
16. Flexible ducts.
17. Duct security bars.
18. Duct accessory hardware.
19. Airflow Monitoring Stations

B. Related Sections:

1. Division 23 Section "HVAC Gravity Ventilators" for roof-mounted ventilator caps.
2. Division 28 Section "Fire Detection and Alarm" for duct-mounted fire and smoke detectors.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

1. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.

B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.

1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:

a. Special fittings.
b. Manual volume damper installations.
c. Control damper installations.
d. Fire-damper, smoke-damper, combination fire- and smoke-damper, ceiling, and corridor damper installations, including sleeves; and duct-mounted access doors and remote damper operators.
e. Duct security bars.
f. Wiring Diagrams: For power, signal, and control wiring.

C. Source quality-control reports.

D. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with AMCA 500-D testing for damper rating.

1.5 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90.
2. Exposed-Surface Finish: Mill phosphatized.

C. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304.

D. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

E. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.

F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.2 BACKDRAFT AND PRESSURE RELIEF DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Air Balance Inc.; a division of Mestek, Inc.
2. American Warming and Ventilating; a division of Mestek, Inc.
3. Greenheck Fan Corporation.
4. Nailor Industries Inc.
5. Pottorff; a division of PCI Industries, Inc.
6. Ruskin Company.
7. SEMCO Incorporated.

B. Description: Gravity balanced.

C. Maximum Air Velocity: 1500 fpm.

D. Maximum System Pressure: 2-inch wg.

E. Maximum Leakage: 40” wide, 1% of max. flow.

F. Frame: 0.09-inch- thick extruded aluminum, with welded corners.

G. Blades: Multiple single-piece blades, maximum 6-inch width, 0.050-inch- thick aluminum sheet with sealed edges.

H. Blade Action: Parallel.

I. Blade Seals: Extruded vinyl, mechanically locked.

J. Blade Axles:

1. Material: Aluminum.
2. Diameter: 0.20 inch.

K. Tie Bars and Brackets: Aluminum.

L. Return Spring: Adjustable tension.

M. Bearings: Steel ball or synthetic pivot bushings.

N. Accessories: (as noted on plans or required by installation)

1. Electric actuators.
2. Chain pulls.
3. Screen Mounting: Front mounted in sleeve.
    a. Sleeve Thickness: 20-gage minimum.
    b. Sleeve Length: 6 inches minimum.
4. Screen Mounting: Rear mounted.
5. Screen Material: Aluminum.
6. Screen Type: Bird or Insect (as noted on drawings)
7. 90-degree stops.

2.3 BAROMETRIC RELIEF DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Air Balance Inc.; a division of Mestek, Inc.
2. American Warming and Ventilating; a division of Mestek, Inc.
3. Greenheck Fan Corporation.
4. Nailor Industries Inc.
5. Pottorff; a division of PCI Industries, Inc.
6. Ruskin Company.
7. SEMCO Incorporated.

B. Suitable for horizontal or vertical mounting.

C. Maximum Air Velocity: 1000 fpm..

D. Maximum System Pressure: 2-inch wg.

E. Maximum Leakage: 40” wide, 1% of max. flow.

F. Frame: 0.09-inch- thick extruded aluminum, with welded corners.

G. Blades:

1. Multiple, 0.025-inch- thick, roll-formed aluminum.
2. Maximum Width: 2 inches.
3. Action: Parallel.
4. Balance: Gravity.
5. Eccentrically pivoted.

H. Blade Seals: Vinyl.

I. Blade Axles: ½” diameter synthetic

J. Tie Bars and Brackets:

1. Material: Aluminum.
2. Rattle free with 90-degree stop.

K. Return Spring: Adjustable tension.

L. Bearings: Synthetic.

M. Accessories: (as noted on plans or required by installation)

1. Adjustment device to permit setting for varying differential static pressure.
2. Counterweights and spring-assist kits for vertical airflow installations.
3. Flange on intake.

2.4 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Air Balance Inc.; a division of Mestek, Inc.
b. American Warming and Ventilating; a division of Mestek, Inc.
c. METALAIRE, Inc.
d. Nailor Industries Inc.
e. Ruskin Company.

2. Suitable for horizontal or vertical applications.
3. Frames:

a. Hat-shaped, galvanized-steel channels, 16-gauge minimum thickness.
b. Mitered and welded corners.
c. Flanges for attaching to walls and flangeless frames for installing in ducts.

4. Blades:

a. Multiple or single blade.
b. Parallel- or opposed-blade design.
c. Stiffen damper blades for stability.
d. Galvanized-steel, 16-gauge thick.

5. Blade Axles: Galvanized steel.
6. Bearings:

a. Molded synthetic.
b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

7. Tie Bars and Brackets: Galvanized steel.

2.5 CONTROL DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Warming and Ventilating; a division of Mestek, Inc.
2. Greenheck Fan Corporation.
3. METALAIRE, Inc.
4. Metal Form Manufacturing, Inc.
5. Nailor Industries Inc.
6. Ruskin Company.

B. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.

C. Frames:

1. Hat shaped.
2. Galvanized-steel channels, 0.064 inch thick.
3. Mitered and welded corners.

D. Blades:

1. Multiple blade with maximum blade width of 8 inches, airfoil design.
2. Opposed-blade design.
3. Galvanized steel.
4. 14-gauge thickness.
5. Blade Edging: Closed-cell neoprene edging.
6. Blade Edging: Inflatable seal blade edging, or replaceable rubber seals.

E. Blade Axles: 1/2-inch- diameter; galvanized steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.

1. Operating Temperature Range: From minus 40 to plus 200 deg F.

F. Bearings:

1. Stainless-steel sleeve.
2. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
3. Thrust bearings at each end of every blade.

2.6 FIRE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Air Balance Inc.; a division of Mestek, Inc.
2. Greenheck Fan Corporation.
3. Nailor Industries Inc.

4. Pottorff; a division of PCI Industries, Inc.
5. NCA Manufacturing.
6. Ruskin Company.

B. Type: Static and dynamic; rated and labeled according to UL 555 by an NRTL.

C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity.

D. Fire Rating: 1-1/2 and 3 hours.

E. Frame: Curtain type with blades outside airstream except when located behind grille where blades may be inside airstream; fabricated with roll-formed, 20-gauge galvanized steel; with mitered and interlocking corners.

F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.

1. Minimum Thickness: 0.052 or 0.138 inch thick, as indicated, and of length to suit application.
2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.

G. Mounting Orientation: Vertical or horizontal as indicated.

H. Blades: Roll-formed, interlocking, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.

I. Horizontal Dampers: Include blade lock and stainless-steel closure spring.

J. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links (unless noted otherwise).

2.7 SMOKE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Air Balance Inc.; a division of Mestek, Inc.
2. Greenheck Fan Corporation.
3. Nailor Industries Inc.
4. NCA Manufacturing.
5. Ruskin Company.

B. General Requirements: Label according to UL 555S by an NRTL.

C. Frame: Multiple-blade type; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.

D. Blades: Roll-formed, horizontal, interlocking, 16-gauge thickness, galvanized sheet steel. Blades shall be true airfoil blades.

E. Leakage: Class I .

F. Rated pressure and velocity to exceed design airflow conditions.

G. Mounting Sleeve: Factory-installed, 20-gauge thickness, galvanized sheet steel; length to suit wall or floor application.

H. Damper Motors: two-position action, electric 120V or 24V as noted on the plans.

I. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 23 Section "Instrumentation and Control for HVAC." and Division 26 Sections.
3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.
5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.
6. Nonspring-Return Motors: For dampers larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf.
7. Electrical Connection: 120V or 24V as noted on the drawings.

J. Accessories: (as indicated on the drawings)

1. Auxiliary switches for or position indication.
2. Momentary test switch, damper mounted.

2.8 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Air Balance Inc.; a division of Mestek, Inc.
2. Greenheck Fan Corporation.
3. Nailor Industries Inc.
4. NCA Manufacturing.
5. Ruskin Company.

B. Type: Dynamic; rated and labeled according to UL 555 and UL 555S by an NRTL.

C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity.

D. Fire Rating: 1-1/2 and 3 hours.

E. Frame: Multiple-blade type; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.

F. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links (unless noted otherwise).

G. Heat-Responsive Device: Electric resettable link and switch package, factory installed, rated.

H. Blades: Roll-formed, horizontal, interlocking, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.

I. Leakage: Class I.

J. Rated pressure and velocity to exceed design airflow conditions.

K. Mounting Sleeve: Factory-installed, 20-gauge thickness, galvanized sheet steel; length to suit wall or floor application.

L. Master control panel for use in dynamic smoke-management systems.

M. Damper Motors: Modulating or two-position action.

N. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 23 Section "Instrumentation and Control for HVAC." and Division 26 Sections.
3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.
5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.
6. Nonspring-Return Motors: For dampers larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf.
7. Electrical Connection: 120V or 24V as noted on the drawings.

O. Accessories: (as indicated on the drawings)

1. Auxiliary switches for position indication.
2. Momentary test switch, damper mounted.

2.9 CORRIDOR DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Air Balance Inc.; a division of Mestek, Inc.
2. Greenheck Fan Corporation.
3. Nailor Industries Inc.
4. NCA Manufacturing.
5. Ruskin Company.

B. General Requirements: Label combination fire and smoke dampers according to UL 555 for 1-1/2-hour rating by an NRTL.

C. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links (unless noted otherwise).

D. Heat-Responsive Device: Electric resettable link and switch package, factory installed, rated.

E. Frame: Multiple-blade type; fabricated with roll-formed, 16-gauge galvanized steel; with mitered and interlocking corners.

F. Blades: Roll-formed, horizontal, interlocking, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.

G. Mounting Sleeve: Factory-installed, 0.052-inch- thick, galvanized sheet steel; length to suit wall or floor application.

H. Damper Motors: Modulating or two-position action.

I. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 23 Section "Instrumentation and Control for HVAC." and Division 26 Sections.
3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.
5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.
6. Nonspring-Return Motors: For dampers larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf.
7. Electrical Connection: 120V or 24V as noted on the drawings.

2.10 DUCT SILENCERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Industrial Noise Control, Inc.
2. McGill AirFlow LLC.
3. Ruskin Company.
4. Vibro-Acoustics.

B. General Requirements:

1. Factory fabricated.
2. Fire-Performance Characteristics: Adhesives, sealants, packing materials, and accessory materials shall have flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested according to ASTM E 84.
3. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2007.

C. Shape:

1. Rectangular straight with splitters or baffles.
2. Round straight with center bodies or pods.
3. Rectangular elbow with splitters or baffles.
4. Round elbow with center bodies or pods.
5. Rectangular transitional with splitters or baffles.

D. Rectangular Silencer Outer Casing: ASTM A 653/A 653M, G60, galvanized sheet steel, 0.034 inch thick.

E. Round Silencer Outer Casing: ASTM A 653/A 653M, G60, galvanized sheet steel.

1. Sheet Metal Thickness for Units up to 24 Inches in Diameter: 0.034 inch thick.
2. Sheet Metal Thickness for Units 26 through 40 Inches in Diameter: 0.040 inch thick.
3. Sheet Metal Thickness for Units 42 through 52 Inches in Diameter: 0.052 inch thick.
4. Sheet Metal Thickness for Units 54 through 60 Inches in Diameter: 0.064 inch thick.

F. Inner Casing and Baffles: ASTM A 653/A 653M, G60 galvanized sheet metal, 0.034 inch thick, and with 1/8-inch- diameter perforations.

G. Special Construction:

1. Suitable for outdoor use.
2. High transmission loss to achieve STC 45.

H. Connection Sizes: Match connecting ductwork unless otherwise indicated.

I. Principal Sound-Absorbing Mechanism:

1. Controlled impedance membranes and broadly tuned resonators without absorptive media.

2. Dissipative type with fill material.

   a. Fill Material: Moisture-proof nonfibrous material.
   b. Erosion Barrier: Polymer bag enclosing fill, and heat sealed before assembly.

3. Lining: Mylar bag.

J. Fabricate silencers to form rigid units that will not pulsate, vibrate, rattle, or otherwise react to system pressure variations. Do not use mechanical fasteners for unit assemblies.

1. Lock form and seal or continuously weld joints.
2. Suspended Units: Factory-installed suspension hooks or lugs attached to frame in quantities and spaced to prevent deflection or distortion.
3. Reinforcement: Cross or trapeze angles for rigid suspension.

K. Source Quality Control: Test according to ASTM E 477.

1. Testing in accordance with ASTM E-477.
2. Record acoustic ratings, including dynamic insertion loss and generated-noise power levels with an airflow of at least 2000-fpm face velocity.
3. Leak Test: Test units for airtightness at 200 percent of associated fan static pressure or 6-inch wg static pressure, whichever is greater.

L. Capacities and Characteristics: As indicated on the drawings.

2.11 TURNING VANES

A. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

B. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-3, "Vanes and Vane Runners," and 2-4, "Vane Support in Elbows."

D. Vane Construction: Single wall for ducts up to 30 inches wide and double wall for larger dimensions.

2.12 REMOTE DAMPER OPERATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Pottorff; a division of PCI Industries, Inc.
2. Ventfabrics, Inc.

3. Young Regulator Company.
4. Metropolitan.

B. Description: Cable system designed for remote manual damper adjustment.

C. Tubing: Brass.

D. Cable: Stainless steel.

E. Wall-Box Mounting: Recessed, 3/4 inches deep.

F. Wall-Box Cover-Plate Material: Stainless steel.

2.13 DUCT-MOUNTED ACCESS DOORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Warming and Ventilating; a division of Mestek, Inc.
2. Ductmate Industries, Inc.
3. Greenheck Fan Corporation.
4. McGill AirFlow LLC.
5. Nailor Industries Inc.
6. Pottorff; a division of PCI Industries, Inc.
7. Ruskin

B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-10, "Duct Access Doors and Panels," and 2-11, "Access Panels - Round Duct."

1. Door:

a. Double wall, rectangular.
b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
c. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
d. Fabricate doors airtight and suitable for duct pressure class.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Number of Hinges and Locks:

a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
c. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches.
d. Access Doors Larger Than 24 by 48 Inches: Four hinges and two compression latches with outside and inside handles.

C. Pressure Relief Access Door:

1. Door and Frame Material: Galvanized sheet steel.
2. Door: Single wall, 12-gauge.

3. Operation: Open outward for positive-pressure ducts and inward for negative-pressure ducts.
4. Factory set at 2” to 10” for positive pressure and -4” to -10” for negative pressure.
5. Doors close when pressures are within set-point range.
6. Hinge: Continuous piano.
7. Latches: Cam.
8. Seal: Neoprene or foam rubber.
9. Insulation Fill: 1-inch- thick, fibrous-glass or polystyrene-foam board.

2.14 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Ventfabrics, Inc.
4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to 2 strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Provide metal compatible with connected ducts.

E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd..
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

1. Minimum Weight: 24 oz./sq. yd..
2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
3. Service Temperature: Minus 50 to plus 250 deg F.

G. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.

1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
2. Outdoor Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch movement at start and stop.

2.15 FLEXIBLE DUCTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flexmaster U.S.A., Inc.
2. McGill AirFlow LLC.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Noninsulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire.

1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 10 to plus 160 deg F.

C. Insulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor-barrier film.

1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 20 to plus 250 deg F.
4. Insulation R-value: Comply with ASHRAE/IESNA 90.1-2007.

D. Flexible Duct Connectors:

1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action or nylon strap in sizes 3 through 18 inches, to suit duct size.

2.16 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

2.17 AIRFLOW MONITORING STATIONS

A. Air Measuring Stations to be furnished under this section of specification and installed under Division 23 Section. Provide where indicated and scheduled, an airflow measuring element assembly capable of continuously monitoring the airflow capacity in the duct.

1. The airflow sensing elements shall be constructed of 6000 Series extruded aluminum, forming two (2) integral chambers for Total and Static pressure averaging, without the physical presence of forward projecting sensors. Individual Total and Static pressure sensing elements are not acceptable.

2. The number of sensing ports on each element, and the quantity of elements utilized at each installation, shall comply with the ASHRAE Standard #111 for duct traversing. The airflow traverse elements shall be capable of producing steady, non-pulsating signals of standard total and static pressure, without amplification nor flow correction (K factors), or field calibration, with an accuracy of 2% of actual flow for operating velocities as low as 100 feet per minute.

3. The airflow elements shall not induce a pressure drop greater than .03" Water Column at 2000 FPM, nor shall the sound level within the duct be amplified by its presence in the air stream. Each airflow measuring element shall contain multiple Total and Static pressure sensors.

4. Where primary flow elements are located outside of the manufacturers published installation guidelines the manufacturer shall be consulted, and approve of any special configurations, such as air equalizers and/or additional and strategically placed measuring points as may be required.

5. Where the stations are installed in insulated ducts, the airflow passage of the station shall be the same size as the inside airflow dimension of the duct. Station flanges shall be two inch to three inch to facilitate matching connecting ductwork.

6. The main take-off point from both the total pressure and the static pressure elements MUST be symmetrical. The probes shall be mounted in an eight inch deep, 16 gauge galvanized steel casing with 90 degree undrilled flanges, fabricated to the duct size, and shall contain multiple airflow traverse elements interconnected as herein before described.

7. An identification label shall be placed on each element listing the Model No., System Served, Size and Identifying Tag Number.

8. The airflow measuring element shall be the FE-1500 as manufactured by Paragon Controls Incorporated (or approval equal).

B. Airflow Indicating Transducers to be furnished and installed under this section of the specification.

1. Provide individual airflow transducers, especially selected for the required design operating spans of each of the above primary elements.

2. The electronic flow transducer(s) shall be solid-state analog type, with infinite resolution to facilitate volume tracking control functions. Microprocessor based transducers with time-sharing of multiple square root extractors and/or controllers are not acceptable.

3. The transducer(s) shall be housed in a NEMA 1 enclosure with integral terminal strip for field wiring, and power and output signal conduit connection port.

4. Each transducer=s output shall not be affected by direction of mounting (attitude) or external vibrations, and shall be furnished with a factory calibrated span. The analog output signal shall be linear to air volume, which is factory set for a full scale value equal to 110% of the maximum design capacity of the flow measuring element served for variable air volume applications, or 200% of the design operating value for constant volume applications.

5. Electronic transducers shall operate on 16 to 36 VDC: Transducer(s) shall have outputs of 4 to 20 mA/2-wire or 0-10VDC/3-wire.

6. Each transducer shall be provided with a local indicating meter. The local digital indicating meter shall be one half-inch high, three and one half digit liquid crystal display (LCD) type. The LCD shall indicate the measured air volume in engineering units of cubic feet per minute (CFM). The meter shall be calibrated to an accuracy of + 1 count.

7. Transducer performance shall be equal or better than the following:

Hysteresis: +0.05%
Linearity: +0.4%
Repeatability: +0.1%
Temperature Effects: <+0.03% F.S./□F
Over-pressure: 5 PSIG Proof
Response: <0.25 seconds for full span input
Noise Filtration: Low Pass Filter, factory set @ 3.2Hz
Transducer Span: < 2 times the design velocity pressure @ maximum flow
Accuracy: +0.5% F.S. (Terminal Point) / +0.35% F.S. (BFSL)

8. The airflow indicating transducers shall be the FIT-1001D as manufactured by Paragon Controls Incorporated (or approval equal).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Install steel volume dampers in steel ducts.
2. Install aluminum volume dampers in aluminum ducts.

E. Set dampers to fully open position before testing, adjusting, and balancing.

F. Install test holes at fan inlets and outlets and elsewhere as indicated.

G. Install fire and smoke dampers according to UL listing and manufacturer's instructions.

H. Connect ducts to duct silencers with flexible duct connectors.

I. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. On both sides of duct coils.
2. Upstream from duct filters.
3. At duct mounted smoke detectors for inspection.
4. At drain pans and seals.
5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
7. Control devices requiring inspection.
8. Elsewhere as indicated.

J. Install access doors with swing against duct static pressure.

K. Access Door Sizes:

1. One-Hand or Inspection Access: 8 by 5 inches.
2. Two-Hand Access: 12 by 6 inches.
3. Head and Hand Access: 18 by 10 inches.
4. Head and Shoulders Access: 21 by 14 inches.
5. Body Access: 25 by 14 inches.
6. Body plus Ladder Access: 25 by 17 inches.

L. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

M. Install flexible connectors to connect ducts to equipment.

N. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

O. Connect terminal units to supply ducts directly or with maximum 6-inch lengths of flexible duct. Do not use flexible ducts to change directions.

P. Connect diffusers or light troffer boots to ducts with maximum 48-inch lengths of flexible duct clamped or strapped in place.

Q. Connect flexible ducts to metal ducts with approved strap and sealant.

R. Install duct test holes where required for testing and balancing purposes.

S. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.
5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 233300

Construction Documents 6/12/24

SECTION 233423

HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. See fan schedule on drawings for additional requirements and specific options required for each fan.

1.2 SUMMARY

A. This Section includes the following:

1. Utility set fans.
2. Centrifugal roof ventilators.
3. Axial roof ventilators.
4. Upblast propeller roof exhaust fans.
5. Centrifugal wall ventilators.
6. Ceiling-mounting ventilators.
7. In-line centrifugal fans.
8. Propeller fans.

1.3 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base fan-performance ratings on sea level.

B. Operating Limits: Classify according to AMCA 99.

1.4 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck
2. Loren Cook Company
3. Penn Ventilation
4. Twin City Fans

B. Listing of manufacturers name does not guarantee approval. All equipment must meet or exceed quality and capacities of specified equipment. Final approval will be based on equipment submittals. Any manufacturer not listed but wishing to bid this project shall submit a

written request 14 days prior to bid date, prior approval is required for all manufacturers not listed.

1.5 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:

1. Certified fan performance curves with system operating conditions indicated.
2. Certified fan sound-power ratings.
3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
4. Material thickness and finishes, including color charts.
5. Dampers, including housings, linkages, and operators.
6. Roof curbs.
7. Fan speed controllers.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, wiring diagrams, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

C. Operation and Maintenance Data: For power ventilators to include operation and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.

C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

D. UL Standard: Power ventilators shall comply with UL 705.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver fans as factory-assembled unit, to the extent allowable by shipping limitations, with protective crating and covering.

B. Disassemble and reassemble units, as required for moving to final location, according to manufacturer's written instructions.

C. Lift and support units with manufacturer's designated lifting or supporting points.

1.8 COORDINATION

A. Coordinate size and location of structural-steel support members.

B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

C. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2 - PRODUCTS

2.1 UTILITY SET FANS

A. Description: Direct- or Belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, and accessories.

B. Housing: Fabricated of galvanized steel with side sheets fastened with a deep lock seam or welded to scroll sheets.

1. Housing Discharge Arrangement: Adjustable to eight standard positions.

C. Fan Wheels: Single-width, single inlet; welded to cast-iron or cast-steel hub and spun-steel inlet cone, with hub keyed to shaft.

1. Blade Materials: Steel.
2. Blade Type: Backward inclined (unless noted otherwise on the fan schedule).

D. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.

E. Shaft Bearings: Prelubricated and sealed, self-aligning, pillow-block-type ball bearings with ABMA 9, L_{50} of 500,000 hours or L_{10} of 100,000 hours.

F. Belt Drives: Factory mounted, with final alignment and belt adjustment made after installation.

1. Service Factor Based on Fan Motor Size: 1.5.
2. Motor Pulleys: Adjustable pitch for use with motors through 10 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
3. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
4. Belt Guards: Fabricate of steel for motors mounted on outside of fan cabinet.

G. Accessories: (See drawings for required accessories).

1. Inlet and Outlet: Flanged.
2. Companion Flanges: Rolled flanges for duct connections of same material as housing.
3. Backdraft Dampers: Gravity actuated with counterweight and interlocking aluminum blades with felt edges in steel frame installed on fan discharge.
4. Access Door: Gasketed door in scroll with latch-type handles.
5. Scroll Dampers: Single-blade damper installed at fan scroll top with adjustable linkage.

6. Inlet Screens: Removable wire mesh.
7. Drain Connections: NPS 3/4 threaded coupling drain connection installed at lowest point of housing.
8. Weather Hoods: Weather resistant with stamped vents over motor and drive compartment.
9. Discharge Dampers: Assembly with opposed blades constructed of two plates formed around and to shaft, channel frame, sealed ball bearings, with blades linked outside of airstream to single control lever of same material as housing.
10. Variable Inlet Vanes: With blades supported at both ends with two permanently lubricated bearings of same material as housing. Variable mechanism terminating in single control lever with control shaft for double-width fans.
11. Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.

H. Coatings: As indicated on the drawings.

I. Capacities and Characteristics: As indicated on the drawings.

2.2 CENTRIFUGAL ROOF VENTILATORS

A. Description: Direct- or belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories.

B. Housing: Removable, spun-aluminum, dome top and outlet baffle; square, one-piece, aluminum base with venturi inlet cone.

1. Upblast Units: Provide spun-aluminum discharge baffle to direct discharge air upward, with rain and snow drains and grease collector for UL 762 kitchen hood exhaust fans.
2. Hinged Subbase: Galvanized-steel hinged arrangement permitting service and maintenance.

C. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.

D. Belt-Driven Drive Assembly: Resiliently mounted to housing, with the following features:

1. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
2. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
3. Pulleys: Cast-iron, adjustable-pitch motor pulley.
4. Fan and motor isolated from exhaust airstream.

E. Accessories: (See drawings for required accessories).

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
2. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
3. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.
4. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.

5. Motorized Dampers: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops. Backdraft dampers on all roof mounted supply fans shall be motorized.

F. Roof Curbs: Galvanized steel; welded corners; 1-1/2-inch- thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to suit roof opening and fan base.

1. Configuration: Self-flashing without a cant strip, with mounting flange.
2. Overall Height: 8 inches (unless noted otherwise).
3. Pitch Mounting: Manufacture curb for roof slope.
4. Metal Liner: Galvanized steel.
5. Burglar Bars: 1/2-inch- thick steel bars welded in place to form 6-inch squares (where indicated on the drawings).
6. Vented Curb: Unlined with louvered vents in vertical sides (where indicated on the drawings).

G. Capacities and Characteristics: As indicated on the drawings.

2.3 AXIAL ROOF VENTILATORS

A. Description: Direct- or belt-driven axial fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories.

B. Housing: Heavy-gage, removable, spun-aluminum, dome top and outlet baffle; square, one-piece, hinged, aluminum base.

1. Hinged Subbase: Galvanized-steel hinged arrangement permitting service and maintenance.

C. Fan Wheel: Aluminum hub and blades.

D. Belt-Driven Drive Assembly: Resiliently mounted to housing, with the following features:

1. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
2. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
3. Pulleys: Cast-iron, adjustable-pitch motor pulley.

E. Accessories: (See drawings for required accessories).

1. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
2. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.
3. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.
4. Motorized Dampers: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops.

F. Roof Curbs: Galvanized steel; welded corners; 1-1/2-inch- thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to suit roof opening and fan base.

1. Configuration: Self-flashing without a cant strip, with mounting flange.
2. Overall Height: 8 inches (unless noted otherwise).
3. Sound Curb: Curb with sound-absorbing insulation matrix.
4. Pitch Mounting: Manufacture curb for roof slope.
5. Metal Liner: Galvanized steel.
6. Burglar Bars: 1/2-inch- thick steel bars welded in place to form 6-inch squares (where indicated on the drawings).

G. Capacities and Characteristics: As indicated on the drawings.

2.4 UPBLAST PROPELLER ROOF EXHAUST FANS

A. Description: Direct- or belt-driven propeller fans consisting of housing, wheel, butterfly-type discharge damper, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories.

B. Wind Band, Fan Housing, and Base: Reinforced and braced galvanized steel, containing butterfly dampers and rain trough, motor and drive assembly, and fan wheel.

1. Damper Rods: Steel with bronze bearings.
2. Hinged Subbase: Galvanized-steel hinged arrangement permitting service and maintenance.

C. Fan Wheel: Replaceable, extruded-aluminum, airfoil blades fastened to cast-aluminum hub; factory set pitch angle of blades.

D. Belt-Driven Drive Assembly: Resiliently mounted to housing; weatherproof housing of same material as fan housing with the following features:

1. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
2. Shaft Bearings: Prelubricated and sealed, self-aligning, pillow-block-type ball bearings.
3. Pulleys: Cast-iron, adjustable-pitch motor pulley.
4. Motor Mount: On outside of fan cabinet, adjustable base for belt tensioning.

E. Roof Curbs: Galvanized steel; welded corners; 1-1/2-inch- thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to suit roof opening and fan base.

1. Configuration: Self-flashing without a cant strip, with mounting flange.
2. Overall Height: 8 inches (unless noted otherwise).
3. Sound Curb: Curb with sound-absorbing insulation matrix.
4. Pitch Mounting: Manufacture curb for roof slope.
5. Metal Liner: Galvanized steel.
6. Burglar Bars: 1/2-inch- thick steel bars welded in place to form 6-inch squares Where indicated on the plans).

F. Capacities and Characteristics: As indicated on the drawings.

2.5 CENTRIFUGAL WALL VENTILATORS

A. Description: Direct- or belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, and accessories.

B. Housing: Heavy-gage, removable, spun-aluminum, dome top and outlet baffle; venturi inlet cone.

C. Fan Wheel: Aluminum hub and wheel with backward-inclined blades.

D. Belt-Driven Drive Assembly: Resiliently mounted to housing, with the following features:

1. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
2. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
3. Pulleys: Cast-iron, adjustable-pitch motor pulley.
4. Fan and motor isolated from exhaust airstream.

E. Accessories: (See drawings for required accessories).

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
2. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through internal aluminum conduit.
3. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.
4. Wall Grille: Ring type for flush mounting.
5. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in wall sleeve; factory set to close when fan stops.
6. Motorized Dampers: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops.

F. Capacities and Characteristics: As indicated on the drawings.

2.6 CEILING-MOUNTING VENTILATORS

A. Description: Centrifugal fans designed for installing in ceiling or wall or for concealed in-line applications.

B. Housing: Steel, lined with acoustical insulation.

C. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.

D. Grille: Plastic, louvered grille with flange on intake and thumbscrew attachment to fan housing.

E. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

F. Accessories: (See drawings for required accessories).

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
2. Manual Starter Switch: Single-pole rocker switch assembly with cover and pilot light.
3. Time-Delay Switch: Assembly with single-pole rocker switch, timer, and cover plate.
4. Motion Sensor: Motion detector with adjustable shutoff timer.
5. Ceiling Radiation Damper: Fire-rated assembly with ceramic blanket, stainless-steel springs, and fusible link.
6. Filter: Washable aluminum to fit between fan and grille.
7. Isolation: Rubber-in-shear vibration isolators.
8. Manufacturer's standard roof jack or wall cap, and transition fittings.

G. Capacities and Characteristics: As indicated on the drawings.

2.7 IN-LINE CENTRIFUGAL FANS

A. Description: In-line, direct- or belt-driven centrifugal fans consisting of housing, wheel, outlet guide vanes, fan shaft, bearings, motor and disconnect switch, drive assembly, mounting brackets, and accessories.

B. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.

C. Direct-Driven Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing.

D. Belt-Driven Units: Motor mounted on adjustable base, with adjustable sheaves, enclosure around belts within fan housing, and lubricating tubes from fan bearings extended to outside of fan housing.

E. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.

F. Accessories:

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
2. Volume-Control Damper: Manually operated with quadrant lock, located in fan outlet.
3. Companion Flanges: For inlet and outlet duct connections.
4. Fan Guards: 1/2- by 1-inch mesh of galvanized steel in removable frame. Provide guard for inlet or outlet for units not connected to ductwork.
5. Motor and Drive Cover (Belt Guard): Galvanized steel.

G. Capacities and Characteristics: As indicated on the drawings.

2.8 PROPELLER FANS

A. Description: Direct- or belt-driven propeller fans consisting of fan blades, hub, housing, orifice ring, motor, drive assembly, and accessories.

B. Housing: Galvanized-steel sheet with flanged edges and integral orifice ring with baked-enamel finish coat applied after assembly.

C. Steel Fan Wheels: Formed-steel blades riveted to heavy-gage steel spider bolted to cast-iron hub.

D. Fan Wheel: Replaceable, extruded-aluminum, airfoil blades fastened to cast-aluminum hub; factory set pitch angle of blades.

E. Belt-Driven Drive Assembly: Resiliently mounted to housing, statically and dynamically balanced and selected for continuous operation at maximum rated fan speed and motor horsepower, with final alignment and belt adjustment made after installation.

1. Service Factor Based on Fan Motor Size: 1.4.
2. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
3. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.

    a. Ball-Bearing Rating Life: ABMA 9, L_{10} of 100,000 hours.

4. Pulleys: Cast iron with split, tapered bushing; dynamically balanced at factory.
5. Motor Pulleys: Adjustable pitch for use with motors through 10 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
6. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
7. Belt Guards: Fabricate of steel for motors mounted on outside of fan cabinet.

F. Accessories: (See drawings for required accessories).

1. Gravity Shutters: Aluminum blades in aluminum frame; interlocked blades with nylon bearings.
2. Motor-Side Back Guard: Galvanized steel, complying with OSHA specifications, removable for maintenance.
3. Wall housing: Galvanized steel to match fan and accessory size.
4. Weathershield Hood: Galvanized steel to match fan and accessory size.
5. Weathershield Front Guard: Galvanized steel with expanded metal screen.
6. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
7. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.

G. Capacities and Characteristics: As indicated on the drawings.

2.9 MOTORS

A. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

B. Enclosure Type: Totally enclosed, fan cooled.

2.10 SOURCE QUALITY CONTROL

A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install power ventilators level and plumb.

B. Support units using spring isolators having a static deflection of 1 inch. Vibration- and seismic-control devices are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

1. Secure vibration and seismic controls to concrete bases using anchor bolts cast in concrete base.

C. Secure roof-mounting fans to roof curbs with cadmium-plated hardware. Refer to Division 07 Section "Roof Accessories" for installation of roof curbs.

D. Ceiling Units: Suspend units from structure; use steel wire or metal straps.

E. Support suspended units from structure using threaded steel rods and spring hangers having a static deflection of 1 inch. Vibration-control devices are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

F. Install units with clearances for service and maintenance.

G. Label units according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Air Duct Accessories."

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Adjust belt tension.
6. Adjust damper linkages for proper damper operation.
7. Verify lubrication for bearings and other moving parts.
8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
10. Shut unit down and reconnect automatic temperature-control operators.
11. Remove and replace malfunctioning units and retest as specified above.

B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Refer to Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.

D. Replace fan and motor pulleys as required to achieve design airflow.

E. Lubricate bearings.

END OF SECTION 233423

Construction Documents 6/12/24

SECTION 233713

DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Round ceiling diffusers.
2. Rectangular and square ceiling diffusers.
3. Perforated diffusers.
4. Louver face diffusers.
5. Linear bar diffusers.
6. Linear slot diffusers.
7. Adjustable Bar Register
8. Fixed face registers.
9. Linear bar grilles.

B. Related Sections:

1. Division 08 Section "Louvers and Vents" for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts.
2. Division 23 Section "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.3 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carnes
2. METALAIRE, Inc.
3. Nailor industries
4. Price
5. Titus
6. Tuttle & Bailey
7. Krueger

B. Listing of manufacturers name does not guarantee approval. All equipment must meet or exceed quality and capacities of specified equipment. Final approval will be based on

equipment submittals. Any manufacturer not listed but wishing to bid this project shall submit a written request 14 days prior to bid date, prior approval is required for all manufacturers not listed.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated, include the following:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

B. Samples for Initial Selection: For diffusers, registers, and grilles with factory-applied color finishes.

C. Samples for Verification: For diffusers, registers, and grilles, in manufacturer's standard sizes to verify color selected.

D. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

1. Ceiling suspension assembly members.
2. Method of attaching hangers to building structure.
3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
5. Duct access panels.

E. Source quality-control reports.

PART 2 - PRODUCTS

2.1 CEILING DIFFUSERS

A. Round Ceiling Diffuser:

1. Devices shall be specifically designed for variable-air-volume flows.
2. Material: Steel or Aluminum as indicated on the drawings.
3. Finish: Baked enamel, white unless noted otherwise.
4. Face Style: Three cone.
5. Mounting: Duct connection.
6. Pattern: Fully adjustable.
7. Dampers: Radial opposed blade.

B. Rectangular and Square Ceiling Diffusers:

1. Devices shall be specifically designed for variable-air-volume flows.
2. Material: Steel or Aluminum as indicated on the drawings.

3. Finish: Baked enamel, white unless noted otherwise.
4. Face Size: 24 by 24 inches or as indicated on the drawings.
5. Face Style: Four cone.
6. Mounting: As required.
7. Pattern: Fixed.
8. Dampers: Radial opposed blade.

C. Perforated Diffuser:

1. Devices shall be specifically designed for variable-air-volume flows.
2. Material: Steel backpan and pattern controllers, with steel or aluminum face as indicated on the drawings.
3. Finish: Baked enamel, white unless noted otherwise.
4. Face Size: 24 by 24 inches or as indicated on the drawings.
5. Duct Inlet: Round or Square as indicated on the drawings.
6. Face Style: Flush.
7. Mounting: T-bar.
8. Pattern Controller: Adjustable with louvered pattern modules at inlet.
9. Dampers: Radial opposed blade.

D. Louver Face Diffuser:

1. Devices shall be specifically designed for variable-air-volume flows.
2. Material: Steel or Aluminum as indicated on the drawings.
3. Finish: Baked enamel, white unless noted otherwise.
4. Face Size: As indicated on the drawings.
5. Mounting: As required.
6. Pattern: Four-way core style, unless noted otherwise.
7. Dampers: Radial opposed blade.

2.2 REGISTERS AND GRILLES

A. Adjustable Bar Register:

1. Material: Steel or Aluminum as indicated on the drawings.
2. Finish: Baked enamel, white unless noted otherwise.
3. Face Blade Arrangement: Horizontal spaced 3/4 inch apart.
4. Core Construction: Integral.
5. Rear-Blade Arrangement: Vertical spaced 3/4 inch apart.
6. Frame: 1-1/4 inches wide.
7. Mounting: Concealed.
8. Damper Type: Adjustable opposed blade.
9. Accessories:

    a. Rear-blade gang operator.
    b. Filter.

B. Fixed Face Register:

1. Material: Steel or Aluminum as indicated on the drawings.

2. Finish: Baked enamel, white unless noted otherwise.
3. Face Arrangement: 1/2-by-1/2-by-1/2-inch grid core.
4. Core Construction: Integral.
5. Frame: 1 inch wide.
6. Mounting: Concealed.
7. Damper Type: Adjustable opposed blade.
8. Accessory: Filter.

C. Linear Bar Grille:

1. Material: Aluminum.
2. Finish: Baked enamel, white unless noted otherwise.
3. Face Arrangement: 1/2-by-1/2-by-1/2-inch grid core.
4. Distribution plenum.
    a. Internal insulation.
    b. Inlet damper.
5. Frame: 1-1/4 inches wide.
6. Mounting: Concealed.
7. Damper Type: Adjustable opposed blade.

2.3 CEILING LINEAR SLOT OUTLETS

A. Linear Slot Diffuser:

1. Devices shall be specifically designed for variable-air-volume flows.
2. Material - Shell: Steel or Aluminum as indicated on the drawings.
3. Material - Pattern Controller and Tees: Aluminum.
4. Finish - Face and Shell: Baked enamel, white exterior with black interior, unless noted otherwise.
5. Finish - Pattern Controller: Baked enamel, black.
6. Finish - Tees: Baked enamel, white.
7. Slot Width: As indicated on the drawings.
8. Number of Slots: as indicated on the drawings.
9. Length: as indicated on the drawings.
10. Accessories:
    a. End caps in lay-in ceilings.
    b. End Borders where not installed in lay-in ceilings.
    c. Insulated plenum: By manufacturer black finish unless otherwise noted.

2.4 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713

Construction Documents 6/12/24

SECTION 233723

HVAC GRAVITY VENTILATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following types of roof-mounting intake and relief ventilators:

1. Louver penthouses.
2. Roof hoods.
3. Goosenecks.

B. Related Sections include the following:

1. Division 08 Section "Louvers and Vents" for ventilator assemblies provided as part of the general construction.
2. Division 23 Section "HVAC Power Ventilators" for roof-mounting exhaust fans.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Intake and relief ventilators shall be capable of withstanding the effects of gravity loads, wind loads, seismic loads (if required), and thermal movements without permanent deformation of components, noise or metal fatigue, or permanent damage to fasteners and anchors.

B. Water Entrainment: Limit water penetration through unit to comply with ASHRAE 62.1-2007.

1.4 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Acme Corp.
2. Greenheck
3. Loren Cook Co.
4. Penn Ventilation
5. Ruskin

B. Listing of manufacturers name does not guarantee approval. All equipment must meet or exceed quality and capacities of specified equipment. Final approval will be based on equipment submittals. Any manufacturer not listed but wishing to bid this project shall submit a written request 14 days prior to bid date, prior approval is required for all manufacturers not listed.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

B. Shop Drawings: For intake and relief ventilators. Include details and ventilator attachments to curbs and curb attachments to roof structure.

C. Welding certificates.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain ventilators through one source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of intake and relief ventilators and are based on the specific equipment indicated. Refer to Division 01 Section "Product Requirements."

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

C. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.2, "Structural Welding Code--Aluminum."
2. AWS D1.3, "Structural Welding Code--Sheet Steel."

1.7 COORDINATION

A. Coordinate installation of roof curbs and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5 or T-52.

B. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming or as otherwise recommended by metal producer for required finish.

C. Galvanized-Steel Sheet: ASTM A 653/A 653M, G90 zinc coating, mill phosphatized.

D. Fasteners: Same basic metal and alloy as fastened metal or 300 Series stainless steel, unless otherwise indicated. Do not use metals that are incompatible with joined materials.

1. Use types and sizes to suit unit installation conditions.
2. Use hex-head or Phillips pan-head screws for exposed fasteners, unless otherwise indicated.

E. Post-Installed Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed, for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187, when noted on the drawings.

2.2 FABRICATION, GENERAL

A. Factory or shop fabricate intake and relief ventilators to minimize field splicing and assembly. Disassemble units to the minimum extent as necessary for shipping and handling. Clearly mark units for reassembly and coordinated installation.

B. Fabricate frames, including integral bases, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

C. Fabricate units with closely fitted joints and exposed connections accurately located and secured.

D. Fabricate supports, anchorages, and accessories required for complete assembly.

E. Perform shop welding by AWS-certified procedures and personnel.

2.3 LOUVER PENTHOUSES

A. Construction: All-welded assembly with 4-inch-deep louvers, mitered corners, and aluminum sheet roof.

B. Frame and Blade Material and Nominal Thickness: Galvanized-steel sheet, of thickness required to comply with structural performance requirements, but not less than 0.052 inch for frames and 0.052 inch for blades.

1. Blade Spacing: 4”.
2. Blade Angle: 45 degrees.
3. Air Performance: Not more than 0.10-inch wg static pressure drop at 750-fpm free-area velocity.

4. AMCA Seal: Mark units with the AMCA Certified Ratings Seal.
5. Exterior Corners: Prefabricated corner units with mitered and welded blades and with fully recessed mullions at corners.

C. Roof Curbs: Galvanized-steel sheet; with mitered and welded corners; 1-1/2-inch- thick, rigid fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to fit roof opening and ventilator base.

1. Configuration: Self-flashing without a cant strip, with mounting flange.
2. Overall Height: 12 inches unless noted otherwise.

D. Insect Screening: Aluminum, 18-by-16 mesh, 0.012-inch wire.

E. Galvanized-Steel Sheet Finish:

1. Surface Preparation: Clean surfaces of dirt, grease, and other contaminants. Clean welds, mechanical connections, and abraded areas and repair galvanizing according to ASTM A 780. Apply a conversion coating suited to the organic coating to be applied over it.
2. Factory Priming for Field-Painted Finish: Where field painting after installation is indicated, apply an air-dried primer immediately after cleaning and pretreating.
3. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil for topcoat and an overall minimum dry film thickness of 2 mils.

a. Color and Gloss: As selected by Architect from manufacturer's full range.

2.4 ROOF HOODS

A. Factory or shop fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figures 5-6 and 5-7.

B. Materials: Galvanized-steel sheet, minimum 0.064-inch- thick base and 0.040-inch- thick hood; suitably reinforced.

C. Roof Curbs: Galvanized-steel sheet; with mitered and welded corners; 1-1/2-inch- thick, rigid fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to fit roof opening and ventilator base.

1. Configuration: Self-flashing without a cant strip, with mounting flange.
2. Overall Height: 12 inches unless noted otherwise.

D. Insect Screening: Aluminum, 18-by-16 mesh, 0.012-inch wire.

E. Galvanized-Steel Sheet Finish:

1. Surface Preparation: Clean surfaces of dirt, grease, and other contaminants. Clean welds, mechanical connections, and abraded areas and repair galvanizing according to ASTM A 780. Apply a conversion coating suited to the organic coating to be applied over it.

2. Factory Priming for Field-Painted Finish: Where field painting after installation is indicated, apply an air-dried primer immediately after cleaning and pretreating.
3. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil for topcoat and an overall minimum dry film thickness of 2 mils.

    a. Color and Gloss: As selected by Architect from manufacturer's full range.

2.5 GOOSENECKS

A. Factory or shop fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 5-5; with a minimum of 0.052-inch- thick, galvanized-steel sheet.

B. Roof Curbs: Galvanized-steel sheet; with mitered and welded corners; 1-1/2-inch- thick, rigid fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to fit roof opening and ventilator base.

1. Configuration: Self-flashing without a cant strip, with mounting flange.
2. Overall Height: 12 inches.

C. Insect Screening: Aluminum, 18-by-16 mesh, 0.012-inch wire.

D. Galvanized-Steel Sheet Finish:

1. Surface Preparation: Clean surfaces of dirt, grease, and other contaminants. Clean welds, mechanical connections, and abraded areas and repair galvanizing according to ASTM A 780. Apply a conversion coating suited to the organic coating to be applied over it.
2. Factory Priming for Field-Painted Finish: Where field painting after installation is indicated, apply an air-dried primer immediately after cleaning and pretreating.
3. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil for topcoat and an overall minimum dry film thickness of 2 mils.

    a. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install intake and relief ventilators level, plumb, and at indicated alignment with adjacent work.

B. Secure intake and relief ventilators to roof curbs with cadmium-plated hardware. Use concealed anchorages where possible. Refer to Division 07 Section "Roof Accessories" for installation of roof curbs.

C. Install goosenecks on curb base where throat size exceeds 9 by 9 inches.

D. Install intake and relief ventilators with clearances for service and maintenance.

E. Install perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

F. Install concealed gaskets, flashings, joint fillers, and insulation as installation progresses. Comply with Division 07 Section "Joint Sealants" for sealants applied during installation.

G. Label intake and relief ventilators according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment."

H. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.

I. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

3.2 CONNECTIONS

A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories.

3.3 ADJUSTING

A. Adjust damper linkages for proper damper operation.

END OF SECTION 233723

SECTION 237200

ENERGY RECOVERY UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes Energy Wheel Air-to-Air Energy Recovery Ventilators for rooftop installation.

1.2 SUBMITTALS

A. Product Data: For each type or model include the following:
   1. Complete fan performance curves for both Supply Air and Exhaust Air, with system operating conditions indicated, as tested in an AMCA Certified Chamber.
   2. Energy wheel performance data for both summer and winter operation.
   3. Motor ratings, electrical characteristics and motor and fan accessories.
   4. Material types and gauges of all component pieces and assemblies.
   5. Dimensioned drawings for each type of installation, showing isometric and plan views, to include location of attached ductwork and service clearance requirements.
   6. Estimated gross weight of each installed unit.
   7. Installation, Operating and Maintenance manual (IOM) for each model.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain unit with all appurtenant components or accessories from a single manufacturer.

B. For the actual fabrication, installation, and testing of work under this section, use only thoroughly trained and experienced workers completely familiar with the items required and with the manufacturer's current recommended methods of installation.

C. Product Options: Drawings must indicate size, profiles and dimensional requirements of Energy Recovery Units and are to be based on the specific system indicated. Refer to Division 1 Section “Product Requirements”.

D. Certifications:
   1. Entire unit shall be AMCA Certified for air flow. AMCA certification of individual components is not acceptable.
   2. Entire unit shall be ETL Certified per U.L. 1995 and bear an ETL sticker.
   3. Energy Wheel shall be AHRI Certified, per Standard 1060.

1.4 COORDINATION

A. Coordinate size and location of all building penetrations required for installation of each unit and associated plumbing and electrical systems.

B. Coordinate sequencing of construction of associated HVAC, electrical supply, roofing contractor.

1.5 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. Filters: One sets of MERV 8 disposable filters for each unit.
   2. One set of fan belts.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with specifications contained within this document, manufacturers offering products that may be incorporated into the work include, but are not limited to:
   1. Greenheck Fan Corporation
   2. Loren Cook Company
   3. Engineered Air

2.2 MANUFACTURED UNITS

A. Unit shall be fully assembled at the factory and consist of an insulated metal cabinet, outdoor air intake weatherhood with metal mesh filters, energy wheel, motorized intake damper, motorized exhaust damper, curb assembly, filter assembly for intake and exhaust air, supply air blower assembly, exhaust air blower assembly and an electrical control center. All specified components and internal accessories factory installed and tested and prepared for single-point high voltage connection.

.

2.3 CABINET

A. Materials: Formed single wall insulated metal cabinet, fabricated to permit access to internal components for maintenance.
   1. Outside casing: 18 gauge, galvanized (G90) steel meeting ASTM A653 for components that do not receive a painted finish.
   2. Internal assemblies: 18 gauge, galvanized (G90) steel except for motor supports which shall be minimum14 gauge galvanized (G90) steel.
B. Access doors shall be hinged.
C. Shall have factory-installed duct flanges on all duct openings.
D. Cabinet Insulation: Comply with NFPA 90A and NFPA 90B and erosion requirements of UL 181.
   1. Materials: Fiberglass insulation. If insulation other than fiberglass is used, it must also meet the Fire Hazard Classification shown below.
      a. Thickness: 1 inch
      b. Fire Hazard Classification: Maximum flame spread of 25 and smoke developed of 50, when tested in accordance with ASTM C 411.
      c. Location and application: Full coverage of entire cabinet exterior to include walls, roof and floor of unit. Insulation shall be of semi-rigid type and installed between inner and outer shells of all cabinet exterior components.
E. Energy wheel: Energy wheel shall be of total enthalpy, rotary air-to-air type and shall be an element of a removable energy wheel cassette. The cassette shall consist of a galvanized steel

framework (designed to produce laminar air flow through the wheel), an energy wheel as specified and a motor and drive assembly. The cassette shall incorporate a pre-tensioned urethane drive belt with a five year warranty. The wheel media shall be a polymer film matrix in a stainless steel framework and be comprised of individual segments that are removable for servicing. Non-segmented energy wheels are not acceptable. Silica gel desiccant shall be permanently bonded to the polymer film and shall be designed and constructed to permit cleaning and servicing. The energy wheel is to have a five year warranty. Performance criteria are to be as specified in AHRI Standard 1060, complying with the Combined Efficiency data in the submittal.

F. Supply Air and Exhaust Air blower assemblies: Blower assemblies consist of an electric motor and a belt driven blower. Assembly shall be mounted on heavy gauge galvanized rails and further mounted on 1.125 inch thick neoprene vibration isolators.
G. Control panel / connections: Energy Recovery Ventilator shall have an electrical control center where all high and low voltage connections are made. Control center shall be constructed to permit single-point high voltage power supply connections
H. Motorized dampers / Exhaust Air, Intake Air: Motorized dampers of low leakage type shall be factory installed.
I. Curb Assembly: A curb assembly made of 14 gauge galvanized steel shall be provided by the factory for assembly and installation as part of this division. The curb assembly shall provide perimeter support of the entire unit. Curb assembly shall enclose the underside of the unit and shall be sized to fit into a recess in the bottom of the unit. Contractor shall be responsible for coordinating with roofing contractor to ensure curb unit is properly flashed to provide protection against weather/moisture penetration. Contractor shall provide and install appropriate insulation for the curb assembly].

2.4 BLOWER

A. Blower section construction, Supply Air and Exhaust Air: Belt drive motor and blower shall be assembled onto a 14 gauge galvanized steel platform and must have neoprene vibration isolation devices.
B. Blower assemblies: Shall be statically and dynamically balanced and designed for continuous operation at maximum rated fan speed and horsepower.
C. Centrifugal blower housing: Formed and reinforced steel panels to make curved scroll housing with shaped cutoff.
D. Forward curved blower (fan) wheels: Galvanized or aluminum construction with inlet flange and shallow blades curved forward in direction of airflow. Mechanically attached to shaft with set screws.
E. Blower performance shall be factory tested for flow rate, pressure, power, air density, rotation speed and efficiency. Ratings are to be established in accordance with AMCA 210, “Laboratory Methods of Testing Fans for Rating”.

2.5 MOTORS

A. General: Blower motors greater than ¾ horsepower shall be “NEMA Premium™” unless otherwise indicated. Minimum compliance with EPAct minimum energy-efficiency standards for single speed ODP and TE enclosures is not acceptable. Motors shall be heavy-duty, permanently lubricated type to match the fan load and furnished at the specified voltage, phase and enclosure. Drives shall be sized for a minimum of 150% of driven horsepower and pulleys shall be fully machined cast-type, keyed and fully secured to the fan wheel and motor shafts. Electric motors of ten horsepower or less shall be supplied with an adjustable drive pulley. Comply with requirements in Division 23 05 13, matched with fan load.

2.6 UNIT CONTROLS:

A. The unit shall be constructed so that it can function as a stand-alone heating and cooling system controlled by factory-supplied controllers, thermostats and sensors or it can be operated as a heating and cooling system controlled by a Building Management System (BMS). This unit shall be controlled by a factory-installed microprocessor programmable controller (DDC) that is connected to various optional sensors.

2.7 FILTERS

A. Unit shall have permanent metal filters located in the outdoor air intake and shall be accessible from the exterior of the unit. MERV 8 disposable pleated filters shall be provided in the intake air stream and MERV 8 filters in the exhaust air stream.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to start of installation, examine area and conditions to verify correct location for compliance with installation tolerances and other conditions affecting unit performance. See unit IOM.

B. Examine roughing-in of plumbing, electrical and HVAC services to verify actual location and compliance with unit requirements. See unit IOM.

C. Proceed with installation only after all unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Installation shall be accomplished in accordance with these written specifications, project drawings, manufacturer's installation instructions as documented in manufacturer's IOM, Best Practices and all applicable building codes.

3.3 CONNECTIONS

A. In all cases, industry Best Practices shall be incorporated. Connections are to be made subject to the installation requirements shown above.

1. Duct installation and connection requirements are specified in Division 23 of this document.
2. Electrical installation requirements are specified in Division 26 of this document.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory authorized service representative to inspect field assembled components and equipment installation, to include electrical and piping connections. Report results to A/E in writing. Inspection must include a complete startup checklist to include (as a minimum) the following: Completed Start-Up Checklists as found in manufacturer's IOM.

3.5 START-UP SERVICE

A. Engage a factory authorized service representative to perform startup service. Clean entire unit, comb coil fins as necessary, and install clean filters. Measure and record electrical values for voltage and amperage. Refer to Division 23 "Testing, Adjusting and Balancing" and comply with provisions therein.

3.6 DEMONSTRATION AND TRAINING:

A. Engage a factory authorized service representative to train owner's maintenance personnel to adjust, operate and maintain the entire unit. Refer to Division 01 Section Closeout Procedures and Demonstration and Training.

END OF SECTION 237433

Construction Documents 6/12/24

SECTION 238126

SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. **BID ALTERNATE #6:** Equipment using refrigerant R410A is being phased out due to Environmental Protection Agency (EPA) regulations. Refrigerant R454B is being utilized by most manufacturers as the replacement moving forward. Equipment selections have not been made available until recently. All equipment bids shall clearly indicate which refrigerant is base bid, and shall provide an alternate for equal equipment utilizing R454B.

1.2 SUMMARY

A. This Section includes split-system air-conditioning and heat pump units consisting of separate evaporator-fan and compressor-condenser components. Units are designed for exposed or concealed mounting, and may be connected to ducts.

1.3 SUBMITTALS

A. Product Data: For each unit indicated. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.

B. Operation and maintenance data.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2007, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

C. ASHRAE/IESNA 90.1-2007 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2007, Section 6 - "Heating, Ventilating, and Air-Conditioning."

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace split-system air-conditioning units that fail in materials and workmanship within five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carrier
2. Lennox
3. Trane/Mitsubishi
4. York

2.2 EVAPORATOR-FAN UNIT

A. Concealed Unit Chassis: Galvanized steel with flanged edges, removable panels for servicing, and insulation on back of panel.

1. Insulation: Faced, glass-fiber duct liner.
2. Drain Pans: Galvanized steel, with connection for drain; insulated and complying with ASHRAE 62.1-2007.
3. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2007.

B. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with thermal-expansion valve.

C. Evaporator Fan: Forward-curved, double-width wheel of galvanized steel; directly connected to motor.

D. Fan Motor: Multispeed.

E. Filters: 1 inch thick, in fiberboard frames.

2.3 AIR-COOLED, COMPRESSOR-CONDENSER UNIT

A. Casing steel, finished with baked enamel, 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.

B. Compressor: Hermetically sealed reciprocating type with crankcase heater and mounted on vibration isolation. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

1. Refrigerant: R-410a (unless otherwise indicated on the drawings).
   a. **BID ALTERNATE #6:** Equipment using refrigerant R410A is being phased out due to Environmental Protection Agency (EPA) regulations. Refrigerant R454B is being utilized by most manufacturers as the replacement moving forward. Equipment selections have not been made available until recently. All equipment bids shall clearly indicate which refrigerant is base bid, and shall provide an alternate for equal equipment utilizing R454B.
      i. Provide units with applicable hard copper piping and pathways with factory refrigerant monitoring devices and BAS point monitoring.

C. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with liquid subcooler.

D. Fan: Aluminum-propeller type, directly connected to motor.

E. Motor: Permanently lubricated, with integral thermal-overload protection.

F. Low Ambient Kit: Permits operation down to 45 deg F.

G. Mounting Base: Polyethylene.

H. Minimum Energy Efficiency: Comply with ASHRAE/IESNA 90.1-2007, "Energy Standard for Buildings except Low-Rise Residential Buildings."

2.4 ACCESSORIES

A. Thermostat: Low voltage with subbase to control compressor and evaporator fan.

B. 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.

1. Minimum Insulation Thickness: 1/2 inch thick.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

B. Install ground-mounted, compressor-condenser components on 4-inch- thick, reinforced concrete base; 4 inches larger on each side than unit. Concrete, reinforcement, and formwork are specified in Division 03 Section "Cast-in-Place Concrete." Coordinate anchor installation with concrete base.

C. Install ground-mounted, compressor-condenser components on polyethylene mounting base.

D. Install roof-mounted, compressor-condenser components on equipment supports specified in Division 07 Section "Roof Accessories." Anchor units to supports with removable, cadmium-plated fasteners.

E. Install compressor-condenser components on restrained, spring isolators with a minimum static deflection of 1 inch. Refer to Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

3.2 CONNECTIONS

A. Connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

B. Connect supply and return condenser connections with shutoff-duty valve and union or flange on the supply connection and with throttling-duty valve and union or flange on the return connection.

C. Install piping adjacent to unit to allow service and maintenance.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connection, and to assist in field testing. 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 motor rotation and unit operation. Remove malfunctioning units, replace with new components, and retest.

D. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

END OF SECTION 238126

SECTION 23 81 46

WATER-SOURCE UNITARY HEAT PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. **BID ALTERNATE #5**: Replace specified Mechanical Heat Pumps with Mechanical Heat Pumps that will satisfy the Domestic content requirements to qualify for Domestic Content Bonus Credit based on Sections 45, 45Y, 48, and 48E, of the Internal Revenue Code. Public Law 17-169, 136 Stat. 1818 (August 16, 2022), commonly known as the Inflation Reduction Act of 2022 (IRA). Unit must still meet/exceed performance requirements outlined by design schedule.

C. **BID ALTERNATE #6:** Equipment using refrigerant R410A is being phased out due to Environmental Protection Agency (EPA) regulations. Refrigerant R454B is being utilized by most manufacturers as the replacement moving forward. Equipment selections have not been made available until recently. All equipment bids shall clearly indicate which refrigerant is base bid, and shall provide an alternate for equal equipment utilizing R454B.

1.2 SUMMARY

A. This Section includes the following types of water-source heat pumps:

1. Concealed horizontal or vertical units, 15 tons and smaller.

1.3 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each model.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Power, signal, and control wiring.

C. Product Certificates: For each type of water-source heat pump, signed by product manufacturer. All equipment listed in this section must be rated and certified in accordance with American Refrigeration Institute / International Standards Organization (ARI / ISO) and Canadian Standards Association (CSA-US). The units shall have ARI / ISO and CSA-US labels

D. Operation and Maintenance Data: For water-source heat pumps to include in emergency, operation, and maintenance manuals.

E. Warranty: Special warranty specified in this Section.

1.4 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Climate Master
2. Enertech/Tetco
3. Water Furnace
4. Daikin
5. Trane

B. Listing of manufacturers name does not guarantee approval. All equipment must meet or exceed quality and capacities of specified equipment. Final approval will be based on equipment submittals. Any manufacturer not listed but wishing to bid this project shall submit a written request 10 days prior to bid date, prior approval is required for all manufacturers not listed.

1.5 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of water-source heat pumps and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. ASHRAE Compliance:

1. ASHRAE 15.
2. Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

D. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6 - "Heating, Ventilating, and Air-Conditioning."

E. Comply with NFPA 70.

F. Comply with safety requirements in UL 484 for assembly of free-delivery water-source heat pumps.

G. Comply with safety requirements in UL 1995 for duct-system connections.

1.6 COORDINATION

A. Coordinate layout and installation of water-source heat pumps and suspension components with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system components, and partition assemblies.

B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

C. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of water-source heat pumps that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, refrigeration components.
2. Warranty Period: Manufacturer shall warranty all parts one year from start-up or 18 months from shipment. The compressor shall have a 5 year warranty. Installing contractor shall provide warranty labor for a period on one year.

PART 2 - PRODUCTS

2.1 WATER-SOURCE HEAT PUMPS

A. Description: Packaged water-source heat pump with temperature controls; factory assembled, tested, and rated according to ARI-ISO-13256-1.

B. Cabinet and Chassis: Galvanized-steel casing, powder coated on both sides, with the following features:

1. Minimum of three (3) Access panels for serviceability of internal components.
2. Knockouts for electrical and piping connections.
3. Flanged duct connections.
4. Compressor Section Cabinet Insulation: Glass-fiber liner, minimum 1/2 inch thick, dual density, 1 ¾lb.
5. Air Handling Section Cabinet Insulation: Glass-fiber liner, minimum 1/2 inch thick, single density, foil backed 1 ¾lb.
6. Standard cabinet panel insulation must meet NFPA 90A requirements, air erosion and mold growth limits of UL-181, stringent fungal resistance test per ASTM-C1071 and ASTM G21, and shall meet zero level bacteria growth per ASTM G22.
7. Condensate Drainage: HDPE or stainless-steel drain pan with condensate drain piping projecting through unit cabinet and complying with ASHRAE 62.1-2004.
8. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.
9. All units must have an insulated panel separating the fan compartment from the compressor compartment. The compressor shall be located outside the air stream.

C. Fan and Motor:

1. General requirements for motors are specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."
2. Blower shall have inlet rings to allow removal of wheel and motor from one side without removing housing. Units shall have a direct-drive centrifugal fan. The fan motor shall be 3-speed, permanently lubricated, PSC or ECM type, with internal thermal overload protection. Units supplied without permanently lubricated motors must provide external oilers for easy service. The fan motor shall be isolated from the fan housing by a torsionally flexible motor mounting system with rubber type grommets to inhibit vibration induced high noise levels associated with “hard wire belly band” motor mounting. The fan and motor assembly must be capable of overcoming the external static pressures as shown on the schedule. Airflow / Static pressure rating of the unit shall be based on a dry coil and a clean filter in place.

D. Water Circuit:

1. Refrigerant-to-Water Heat Exchangers:

   a. Coaxial heat exchangers with copper water tube with enhanced heat-transfer surfaces inside a steel shell; both shell and tube leak tested to 500 psig on refrigerant side and 400 psig on water side. Factory mount heat exchanger in unit on resilient rubber vibration isolators.
   b. Stainless-steel, brazed-plate heat exchanger leak tested to 450 psig for refrigerant side and 400 psig for water side. Factory mount heat exchanger in unit on resilient rubber vibration isolators.
2. Motorized Water Valve: Stop water flow through the unit when compressor is off.

E. Refrigerant-to-Air Coils: Copper tubes with aluminum fins, leak tested to 450 psig.

F. Refrigerant Circuit Components:

1. Sealed Refrigerant Circuit: Charge with R-407C or R-410A refrigerant.

   a. **BID ALTERNATE #6:** Equipment using refrigerant R410A is being phased out due to Environmental Protection Agency (EPA) regulations. Refrigerant R454B is being utilized by most manufacturers as the replacement moving forward. Equipment selections have not been made available until recently. All equipment bids shall clearly indicate which refrigerant is base bid, and shall provide an alternate for equal equipment utilizing R454B.
      i. Provide units with applicable factory refrigerant monitoring devices and BAS point monitoring.
2. Filter-Dryer: Factory installed to clean and dehydrate the refrigerant circuit.
3. Charging Connections: Service fittings on suction and liquid for charging and testing.
4. Reversing Valve: Pilot-operated sliding-type valve designed to be fail-safe in heating position with replaceable magnetic coil.
5. Compressor: Hermetic rotary or scroll compressor installed on vibration isolators and housed in an acoustically treated enclosure with factory-installed safeties. Activation of any safety device shall prevent compressor operation via a microprocessor lockout circuit. The lockout circuit shall be reset at the thermostat or at the contractor supplied disconnect switch. Factory installed safeties required as follows:

   a. Anti- short cycle timer.
   b. High-pressure cutout.

c. Low-pressure cutout or loss of charge switch.
d. Water coil low temperature sensor
e. Air coil low temperature sensor
f. Condensate overflow sensor

6. Refrigerant Piping Materials: ASTM B 743 copper tube with wrought-copper fittings and brazed joints.
7. Pipe Insulation: Refrigerant minimum 3/8-inch- thick, flexible elastomeric insulation on piping exposed to airflow through the unit. Maximum 25/50 flame-spread/smoke-development indexes according to ASTM E 84.
8. Refrigerant Metering Device: Thermal expansion valve to allow specified operation with entering-water temperatures from 40 to 100 deg F.

G. Filters: Disposable, pleated type, 1 inch thick and with a minimum of 90 percent arrestance according to ASHRAE 52.1 and a minimum efficiency reporting value of 7 according to ASHRAE 52.2.

H. Sound Attenuation (required for classroom units only):

1. Ultra quiet package shall consist of high technology sound attenuating material that is strategically applied to the compressor and air handling compartment casings and fan scroll in addition to the standard system design, to further dampen and attenuate sound transmissions.

I. Hot gas reheat (where indicated)

1. Dehumidification (where indicated) is provided through a hot gas reheat option. The coil shall consist of 3/8"/1/2" copper tubes mechanically expanded into evenly spaced aluminum fins. All coils shall be proof and leak tested. The proof test must be performed at 1.5 times the maximum operating pressure and the leak test performed at the maximum operating pressure.

J. Drain Pan: the drain pan shall be constructed of 304 Stainless Steel to inhibit corrosion. This corrosion protection system shall meet the stringent 1000 hour salt spray test per ASTM B117. If plastic type material is used, it must be HDPE (High Density Polyethylene) to avoid thermal cycling shock stress failure over the lifetime of the unit. Drain pan shall be fully insulated. Drain outlet shall be located at pan as to allow complete and unobstructed drainage of condensate. Drain outlet for horizontal units shall be connected from pan directly to IPT fitting. The unit as standard will be supplied with solid-state electronic condensate overflow protection.
Vertical units shall be furnished with a PVC slip condensate drain connection and an internal factory installed condensate trap.

K. Control equipment is specified in Division 23 Sections "Instrumentation and Controls for HVAC." See plans for Sequence of Operation.

L. Controls:

Solid state control system shall communicate with thermostat to display (at the thermostat) the unit status, fault status, and specific fault condition, as well as retrieve previously stored fault that caused unit shutdown. The Remote Service Sentinel allows building maintenance personnel or service personnel to diagnose unit from the wall thermostat. The control board

shall provide a signal to the thermostat fault light, indicating a lockout. Upon cycling the G (fan) input 3 times within a 60 second time period, the fault light shall display the specific code as indicated by a sequence of flashes. A detailed flashing code shall be provided at the thermostat LED to display unit status and specific fault status such as over/under voltage fault, high pressure fault, low pressure fault, low water temperature fault, condensate overflow fault, etc. The control board will be supplied with a LONWORKS interface board, which is LONMark certified. This will permit all units to be daisy chained via a 2-wire twisted pair shielded cable. The following points must be available at a central or remote computer location:

a. space temperature
b. leaving water temperature
c. discharge air temperature
d. command of space temperature setpoint
e. cooling status
f. heating status
g. low temperature sensor alarm
h. low pressure sensor alarm
i. high pressure switch alarm
j. condensate sensor alarm
k. hi/low voltage alarm
l. fan "ON/AUTO" position of space thermostat as specified above
m. unoccupied / occupied command
n. cooling command
o. heating command
p. fan "ON / AUTO" command
q. fault reset command
r. itemized fault code revealing reason for specific shutdown fault (any one of 7)

M. Electrical Connection: Single electrical connection.

N. Capacities and Characteristics: As indicated on the drawings.

2.2 HOSE KITS

A. General: Hose kits shall be designed for minimum 400 psig working pressure, and operating temperatures from 33 to 211 deg F. Tag hose kits to equipment designations.

B. Hose: Length 24 inches. Minimum diameter, equal to water-source heat-pump connection size.

C. Isolation Valves: Two-piece bronze-body ball valves with stainless-steel ball and stem and galvanized-steel lever handle. Provide valve for supply and return. If balancing device is combination shutoff type with memory stop, the isolation valve may be omitted on the return.

D. Strainer: Y-type with blowdown valve in supply connection.

E. Balancing Device: Mount in return connection. Include meter ports to allow flow measurement with differential pressure gage.

1. Automatic balancing valve, factory set to operate within +/-5% of gpm rating. Cartridge must be accessible without removing valve from piping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of water-source heat pumps.

B. Examine roughing-in for piping and electric installations for water-source heat pumps to verify actual locations of piping connections and electrical conduit before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Concrete Bases: Install floor mounted units on 4-inch- high concrete bases. See Division 23 Section "Common Work Results for HVAC" for concrete base materials and fabrication requirements.

B. Unless otherwise noted, mount horizontal and vertical water-source heat pumps on concrete base with vibration isolators. Vibration isolators are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

1. Units with Internally Isolated Fans and Compressors: Support on concrete bases using neoprene pads with minimum 0.125-inch static deflection. Secure units to anchor bolts installed in concrete bases.
2. Units without Internally Isolated Fans and Compressors: Support on concrete bases using housed-spring isolators with minimum 1-inch static deflection. Secure units to anchor bolts installed in concrete bases.
3. Install units level.

3.3 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties. Specific connection requirements are as follows:

1. Connect supply and return hydronic piping to heat pump with hose kits.
2. Connect heat-pump condensate drain pan to indirect waste connection with condensate trap of adequate depth to seal against the pressure of fan. Install cleanouts in piping at changes of direction.

B. Duct installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts. Specific connection requirements are as follows:

1. Connect supply and return ducts to water-source heat pumps with flexible duct connectors specified in Division 23 Section "Air Duct Accessories."

C. Install electrical devices furnished by manufacturer but not specified to be factory mounted.

D. Install piping adjacent to machine to allow service and maintenance.

E. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

F. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. After installing water-source heat pumps and after electrical circuitry has been energized, test units for compliance with requirements.
2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Remove and replace malfunctioning units and retest as specified above.

3.5 STARTUP SERVICE (Provided by Installing Contractor)

A. Complete installation and startup checks according to manufacturer's written instructions and do the following:

1. Inspect for visible damage to unit casing.
2. Inspect for visible damage to compressor, coils, and fans.
3. Inspect internal insulation.
4. Verify that labels are clearly visible.
5. Verify that clearances have been provided for servicing.
6. Verify that controls are connected and operable.
7. Verify that filters are installed.
8. Adjust vibration isolators.
9. Inspect operation of barometric dampers.
10. Verify bearing lubrication on fan.
11. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
12. Adjust fan belts to proper alignment and tension.
13. Start unit according to manufacturer's written instructions.
14. Complete startup sheets and attach copy with Contractor's startup report.
15. Inspect and record performance of interlocks and protective devices; verify sequences.
16. Operate unit for an initial period as recommended or required by manufacturer.
17. Verify thermostat and humidistat calibration.
18. Inspect outdoor-air dampers for proper stroke and interlock with return-air dampers.
19. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
20. Start refrigeration system and measure and record the following:

    a. Coil leaving-air, dry- and wet-bulb temperatures.
    b. Coil entering-air, dry- and wet-bulb temperatures.
    c. Outdoor-air, dry-bulb temperature.
    d. Outdoor-air-coil, discharge-air, dry-bulb temperature.

21. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.

a. Supply-air volume.
b. Return-air volume.
c. Relief-air volume.
d. Outdoor-air intake volume.

3.6 ADJUSTING

A. Adjust initial temperature and humidity set points.

B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.

3.7 CLEANING

A. Replace filters used during construction prior to air balance or substantial completion.

B. After completing installation of exposed, factory-finished water-source heat pumps, inspect exposed finishes and repair damaged finishes.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain water-source heat pumps. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION

Construction Documents 6/12/24