PROJECT MANUAL / TECHNICAL SPECIFICATIONS FOR

ROCKLAND GREEN MRF FACILITY IMPROVEMENTS

420 TORNE VALLEY ROAD, HILLBURN, NY 10931

ISSUED FOR RFP: JULY 30, 2021

OWNER ENGINEER:

RRT Engineering, LLC
1 Huntington Quadrangle, 3S01
Melville, NY 11747

ARCHITECT:

Jason T. Anderson Architect, P.C.
dba Anderson Design Group
Architecture ■ Planning ■ Interiors

25 Wallkill Avenue
Montgomery, NY 12549

MEP ENGINEER:

Martin Rogers
Engineering Consultants

185 N. Pennsylvania Avenue
Wilkes-Barre, PA 18701

CIVIL ENGINEER:

Sterling Environmental Engineering, P.C.
24 Wade Road
Latham, NY 12110

STRUCTURAL ENGINEER:

RRT Engineering, LLC
1 Huntington Quadrangle, 3S01
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[SEPARATION PAGE]

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Melville, NY 11747

REGISTERED ARCHITECT JASON T. ANDERSON 033127 STATE OF NEW YORK 07-06-2021	STATE OF NEW YORK ANDREW M. MILLSPAUGH 094708 LICENSED PROFESSIONAL ENGINEER	STATE OF NEW YORK MARK A. FRANZ 082717 LICENSED PROFESSIONAL ENGINEER 7/6/21	STATE OF NEW YORK MICHAEL BRITTON No. 085559 LICENSED PROFESSIONAL ENGINEER
Design Architect	Design Engineer – Civil	Design Engineer – Structural	Design Engineer – Mechanical
STATE OF NEW YORK MICHAEL BRITTON No. 085559 LICENSED PROFESSIONAL ENGINEER	STATE OF NEW YORK MICHAEL BRITTON No. 085559 LICENSED PROFESSIONAL ENGINEER	STATE OF NEW YORK MICHAEL BRITTON No. 085559 LICENSED PROFESSIONAL ENGINEER	STATE OF NEW YORK MICHAEL BRITTON No. 085559 LICENSED PROFESSIONAL ENGINEER
Design Engineer – Plumbing	Design Engineer – Electrical	Design Engineer – Fire Sprinkler	Design Engineer – Fire Alarm

NOT FOR CONSTRUCTION

[SEPARATION PAGE]

SECTION 000110
TABLE OF CONTENTS

SPECIFICATIONS

A. END OF SECTION

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SECTION 011000
SUMMARY

PART 1 GENERAL

1.01 PROJECT

A. Project Name: A-B 499-010 Rockland Green MRF - Area 1-6 Alterations

B. The Project consists of the alteration of an existing Recycling facility..

1.02 CONTRACT DESCRIPTION

A. The work is identified in the Technical Specifications and on the Construction Plans.

B. It is the intent of the Construction Plans and Technical Specifications to provide alterations and/or new construction as indicated on the Construction Plans and in the Technical Specifications to provide complete systems in every respect, capable of operating as designed. It is not intended that every fitting, minor detail or feature be shown on Construction Plans. The Contractor shall be responsible for any detail necessary for completion of these systems in accordance with good practice and standard of care for this region. Installation shall be executed so as to contribute to efficiency of operation, minimum maintenance, accessibility and sight lines. The installation shall conform and accommodate itself to the building structure, its equipment and its usage. No piping or equipment shall be installed in such a manner as to interfere with the operation of any doors or windows. Requirements specified herein shall govern applicable portion of all sections whether so stated herein or not.

C. The Contractor shall be advised that where noted, the use of a brand name is for the purpose of describing the standard of quality, performance and characteristics desired and is in no way intended to limit or restrict competition.

D. The Contractor shall be advised that he shall be responsible for the coordination of his aspect of the project with all other contractors and that all drawings and specifications pertaining to the project, whether or not specifically called out in the following scope of work.

E. Each Prime Contractor shall develop their own CPM schedule and will integrate it with the over-all project schedule; this schedule will be discussed at weekly job meetings and updated as noted in the specifications.

F. Each Contractor will abide by all NYS DOL and OSHA safety standards and upon notice of award, submit to the owner a company written safety program. Documentation of the implementation of the Company's safety program will be reviewed at weekly job meetings. Each Contractor's Sub-contractor, before beginning work on the project will submit their own written safety program to the applicable Contractor and to the Owner.

G. Provide all Work except Work specifically assigned to other Contractors in this Section.

1.03 OWNER OCCUPANCY

A. Owner intends to make partial use of the premises (i.e., parking, storage, etc.) during construction.

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

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

D. Schedule the Work to accommodate Owner occupancy.

1.04 CONTRACTOR USE OF SITE AND PREMISES

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

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SECTION 012500
SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedural requirements for proposed substitutions.

1.02 DEFINITIONS

A. Substitutions: Changes from Contract Documents requirements proposed by Contractor to materials, products, assemblies, and equipment.
   1. Substitutions for Cause: Proposed due to changed Project circumstances beyond Contractor's control, subject to substantiation.
      a. Unavailability.
      b. Regulatory changes.
   2. Substitutions for Convenience: Proposed due to possibility of offering substantial advantage to the Project, subject to substantiation.
      a. Substitution requests offering advantages solely to the Contractor will not be considered.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:
   1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
   2. Agrees to provide the same warranty for the substitution as for the specified product.
   3. Agrees to provide same or equivalent maintenance service and source of replacement parts, as applicable.
   4. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
   5. Waives claims for additional costs or time extension that may subsequently become apparent.

B. A Substitution Request for specified installer constitutes a representation that the submitter:
   1. Has acted in good faith to obtain services of specified installer, but was unable to come to commercial, or other terms.

C. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on the Contractor.
   1. Note explicitly any non-compliant characteristics.

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

E. Limit each request to a single proposed substitution item.
   1. Submit an electronic document, combining the request form with supporting data into single document.

3.02 SUBSTITUTION PROCEDURES DURING CONSTRUCTION

A. Submit request for Substitution for Cause within 14 days of discovery of need for substitution, but not later than 14 days prior to time required for review and approval by Engineer, in order to stay on approved project schedule.

B. Submit request for Substitution for Convenience immediately upon discovery of its potential advantage to the project, but not later than 14 days prior to time required for review and approval by Engineer, in order to stay on approved project schedule.
   1. In addition to meeting general documentation requirements, document how the requested substitution benefits the Owner through cost savings, time savings, greater energy conservation, or in other specific ways.
   2. Document means of coordinating of substitution item with other portions of the work, including work by affected subcontractors.

3. Bear the costs engendered by proposed substitution of:
   a. Owner's compensation to the Engineer for any required redesign, time spent processing and evaluating the request.

3.03 RESOLUTION

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

B. Engineer will notify Contractor in writing of decision to accept or reject request.
   1. Engineer's decision following review of proposed substitution will be noted on the submitted form.

3.04 ACCEPTANCE

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

END OF SECTION

SECTION 013000
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electronic document submittal service.

B. Pre-construction meeting.

C. Progress meetings.

D. Construction progress schedule.

E. Progress photographs.

F. Coordination drawings.

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

H. Number of copies of submittals.

I. Submittal procedures.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRECONSTRUCTION MEETING

A. Owner and Engineer will schedule a meeting after Notice of Award.

B. Attendance Required:
   1. Owner.
   2. Engineer.
   3. Prime Contractors (as applicable)..

C. Agenda:
   1. Execution of Owner-Contractor Agreement.
   2. Submission of executed bonds and insurance certificates.
   3. Distribution of Contract Documents.
   4. Designation of personnel representing the parties to Contract.
   5. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
   6. Scheduling.
   7. Security and housekeeping procedures.
   8. Procedures for testing.
   9. Application for payment procedures.

3.02 PROGRESS MEETINGS

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

B. Attendance Required:
   1. Owner.
   2. Engineer.
   3. Prime Contractor's
   4. Special consultants.
   5. Prime Contractor's Superintendent's.
   6. Major subcontractors.

C. Agenda:
   1. Review minutes of previous meetings.
   2. Review of work progress.
   3. Field observations, problems, and decisions.
   4. Identification of problems that impede, or will impede, planned progress.
   5. Review of submittals schedule and status of submittals.
   6. Review of off-site fabrication and delivery schedules.
   7. Maintenance of progress schedule.

8. Corrective measures to regain projected schedules.
9. Planned progress during succeeding work period.
10. Coordination of projected progress.
11. Maintenance of quality and work standards.
12. Effect of proposed changes on progress schedule and coordination.
13. Other business relating to work.

3.03 CONSTRUCTION PROGRESS SCHEDULE - SEE SECTION 013216

A. If preliminary schedule requires revision after review, submit revised schedule within 2 days.

B. Within 7 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
   1. Include written certification that major contractors have reviewed and accepted proposed schedule.

C. Within 5 days after joint review, submit complete schedule.

D. Submit updated schedule with each Application for Payment.

3.04 PROGRESS PHOTOGRAPHS

A. Submit photographs with each application for payment, taken not more than 3 days prior to submission of Application for Payment.

B. Photography Type: Digital; electronic files.

C. In addition to periodic, recurring views, take photographs of each of the following events:
   1. Completion of demolition and site clearing.
   2. Excavations in progress.
   3. Foundations in progress and upon completion.
   4. Structural framing in progress and upon completion.
   5. Enclosure of building, upon completion.
   6. Final completion, minimum of 30 photos.

3.05 COORDINATION DRAWINGS

A. Provide information required by Project Coordinator for preparation of coordination drawings.

B. Review drawings prior to submission to Engineer.

3.06 BASIC SUBMITTAL PROCEDURES

A. Submit electronically in hard copy format. Submit one (1) original each Application for Payment.

B. Submit an updated construction schedule specified in Section 01 041-Project Coordination, and updated Network Schedule as specified in Section 01 311 - Network Analysis Schedules.

C. Submit Record Drawings showing limits, elevations and grades for Work completed as of date of payment request with each Application for Payment.

D. Payment Period - Submit at intervals stipulated in the Owner-Contractor Agreement. Submit under transmittal letter.

E. Application for Payment will not be processed unless it is complete and contains all of the above specified items for the work covered by the payment request.

3.07 SUBSTANTIATING DATA

A. When Engineer requires substantiating information, submit data justifying dollar amounts in question.
   1. Provide one (1) copy of data with cover letter for each copy of submittal. Show Application number and date, and line item by number and description.

3.08 SUBMITTALS FOR REVIEW

A. When the following are specified in individual sections, submit them for review:
   1. Product and Performance data.
   2. Shop drawings.

3. Samples for selection.
4. Samples for verification.

B. Submit to Engineer for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.

C. Samples will be reviewed for aesthetic, color, or finish selection.
1. Physical samples of all finishes must be submitted.

D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 017800 - Closeout Submittals.

3.09 SUBMITTALS FOR INFORMATION

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

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

3.10 SUBMITTALS FOR PROJECT CLOSEOUT

A. Submit Punch List for Substantial Completion.

B. Submit Final Punch List for Substantial Completion.

C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 017800 - Closeout Submittals:
1. Project record documents.
2. Operation and maintenance data.
3. Warranties.
4. Other types as indicated.

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

3.11 NUMBER OF COPIES OF SUBMITTALS

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

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

END OF SECTION

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SECTION 013216
CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preliminary schedule.

B. Construction progress schedule, with network analysis diagrams and reports.

1.02 REFERENCE STANDARDS

A. AGC (CPSM) - Construction Planning and Scheduling Manual 2004.

B. M-H (CPM) - CPM in Construction Management - Project Management with CPM 2015.

1.03 SUBMITTALS

A. Within 10 days after date of Agreement, submit preliminary schedule.

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

C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.

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

E. Submit updated schedule for the weekly meeting.

1.04 SCHEDULE FORMAT

A. Listings: In chronological order according to the start date for each activity. Identify each activity with the applicable specification section number.

B. Critical Path method

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRELIMINARY SCHEDULE

A. Prepare preliminary schedule in the form of a horizontal bar chart.

3.02 CONTENT

A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.

B. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.

C. Provide legend for symbols and abbreviations used.

3.03 NETWORK ANALYSIS

A. Prepare network analysis diagrams and supporting mathematical analyses using the Critical Path Method.

B. Illustrate order and interdependence of activities and sequence of work; how start of a given activity depends on completion of preceding activities, and how completion of the activity may restrain start of subsequent activities.

C. Required Reports: List activities in sorts or groups:
   1. By preceding work item or event number from lowest to highest.
   2. By amount of float, then in order of early start.

3.04 REVIEW AND EVALUATION OF SCHEDULE

A. Participate in joint review and evaluation of schedule with Engineer at each submittal.

B. Evaluate project status to determine work behind schedule and work ahead of schedule.

C. After review, revise as necessary as result of review, and resubmit within 5 days.

3.05 UPDATING SCHEDULE

A. Maintain schedules to record actual start and finish dates of completed activities.

B. Indicate progress of each activity to date of revision, with projected completion date of each activity.

C. Coordinate all activities with all activities of other Prime Contractors and Owner, resulting in an integrated schedule without conflicts.

D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.

E. Indicate changes required to maintain Date of Substantial Completion.

F. Submit reports required to support recommended changes.

END OF SECTION

SECTION 014100
REGULATORY REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY OF REFERENCE STANDARDS

A. Regulatory requirements applicable to this project are the following, including all subsequent amendments and updates: In addition to the reference standards set forth below, Contractor must comply with the Contract Standards, as defined in the RFP (Rockland Green RFP 2021-10) and included in the Contract.

B. 28 CFR 35 - Nondiscrimination on the Basis of Disability in State and Local Government Services; Final Rule; Department of Justice current edition.

C. 28 CFR 36 - Nondiscrimination by Public Accommodations and in Commercial Facilities; Final Rule; Department of Justice current edition.

D. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines current edition.

E. FED-STD-795 - Uniform Federal Accessibility Standards (UFAS) 1988.

F. 29 CFR 1910 - Occupational Safety and Health Standards current edition.

G. State of New York amendments to some or all of the following (2016 Supplement).

H. NFPA 1 - Fire Code 2018.

I. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. ICC (IBC) - International Building Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

K. ICC (IPC) - International Plumbing Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

M. ICC (IECC) - International Energy Conservation Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

N. ICC A117.1 - International Fire Code; 2015

O. ICC (IMC) - International Mechanical Code; 2015

P. ICC (IECC) - International Energy Conservation Code; 2015

Q. ICC (IPMC) - International Property Maintenance Code; 2015

R. ICC (IFC) - International Fire Code: 2015

S. ECC SUPP NY - Supplement to the New York State Energy Conservation Construction Code; 2016

T. UCS NY - Uniform Code Supplement; 2016

U. Federal Regulation 40 CFR Part 763 and Part 61 (Subpart M)

V. Federal Regulations Occupational Safety and Health Administration (OSHA)

W. New York State Regulations 10 NYCRR Part 73

X. New York State Regulations 12 NYCRR Part 56

Y. New York State Regulations 6 NYCRR Part 360

Z. New York State Regulations 6 NYCRR Part 364

AA. ICC (IFGC) - International Fuel Gas Code 2015 1FGC NY 2015.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SECTION 014215
ABBREVIATIONS AND SYMBOLS

PART 1 GENERAL

1.01 SYSTEM DESCRIPTION

A. Where any of the following abbreviations of standards, associations, specifications or publications are used in the Contract Documents, they shall have the meaning set forth opposite each and shall be the latest revision thereof at the time of bidding.

1. AA Aluminum Association
2. AAA Aluminum Alloy Association AAMA -
3. AABC Associated Air Balance Council
4. AAMA Architectural Aluminum
5. AAN American Association of Nurserymen
6. AASHTO American Association of State Highway and Transportation Officials
7. ACGIH American Conference of Governmental Industrial Hygienists
8. ACI American Concrete Institute
9. ACPA American Concrete Pipe Association
10. AFBMA Anti Friction Bearing Manufacturers Association
11. AGA American Gas Association
12. AGC Associated General Contractors of America
13. AGMA American Gear Manufacturers Association
14. AGWA American Gear Works Association
15. AHA American Hardboard Association
16. AI Asphalt Institute
17. AIA American Institute of Architects
18. AIEE American Institute of Electrical Engineers
19. AISC American Institute of Steel Construction
20. AISI American Iron and Steel Institute
21. AITC American Institute of Timber Construction
22. AMCA Air Moving and Conditioning Association
23. ANSI American National Standards Institute (Synonymous with USASI-ASA)
24. APA American Plywood Association
25. API American Petroleum Institute
26. ARA American Railroad Association
27. ARI Air Conditioning and Refrigeration Institute
28. AREA American Railway Engineering Association
29. ASCE American Society of Civil Engineers
30. ASHRAE American Society of Heating, Refrigeration and Air Conditioning Engineers
31. ASLA American Society of Landscape Architects
32. ASME American Society of Mechanical Engineers
33. ASTM American Society for Testing and Materials
34. AWG American (or Brown and Sharpe) Wire Gauge
35. AWI Architectural Woodwork Institute
36. AWPA American Wood Preservers Association
37. AWPB American Wood Preservers Bureau
38. AWPI American Wood Preservers Institute
39. AWS American Welding Society
40. AWWA American Water Works Association
41. BIA Brick Institute of America
42. BOCA Building Officials and Code Administrators International
43. CEMA Conveyor Equipment Manufacturers Association
44. CGA Compressed Gas Association
45. CISPI Cast Iron Soil Pipe Institute
46. CSPC Consumer Product Safety Commission
47. CRSI Concrete Reinforcing Steel Institute
48. CSA Canadian Standards Association

49. CTC Concrete Technology Corporation
50. DEC New York State Department of Environmental Conservation
51. DOC United States Department of Commerce
52. DOD United States Department of Defense
53. DOT New York State Department of Transportation
54. EEI Edison Electrical Institute
55. EJMA Expansion Joint Manufacturers Association
56. EPA United States Department of Environmental Protection
57. FHWA Federal Highway Administration, U.S. Dept. of Transportation
58. FM Factory Mutual Engineering Corporation
59. FSS Federal Specifications and Standards (General Services Administration -- Federal Supply Service)
60. GA-Gypsum Association
61. GWB Gypsum Wallboard
62. HPMA Hardwood Plywood Manufacturers Association
63. IBR Institute of Boiler and Radiator Manufacturers
64. ICBO International Congress of Building Officials
65. IBR Institute of Boiler and Radiator Manufacturers
66. ICBO International Congress of Building Officials
67. IEEE Institute of Electrical and Electronic Engineers
68. IES Illuminating Engineering Society
69. IMIAWC International Masonry Industry All Weather Council
70. IMSA International Municipal Signal Association
71. IPCEA Insulated Power Cable Engineers Association
72. ITE Institute of Traffic Engineers
73. MBMA Metal Building Manufacturers Association
74. MMA Monorail Manufacturers Association
75. MSS Manufacturers Standardization Society
76. MUTCD Manual on Uniform Traffic Control Devices
77. NBFU National Board of Fire Underwriters
78. NBS National Bureau of Standards
79. NCMA National Concrete Masonry Association
80. NEBB National Environmental Balancing Bureau
81. NEC National Electrical Code
82. NELA National Electric Light Association
83. NEMA National Electrical Manufacturers Association
84. NESC National Electrical Safety Code
85. NFIPA National Fire Protection Association
86. NFOPA National Forest Products Association
87. NIOSH National Institute for Occupational Safety and Health
88. NRMCA National Ready Mix Concrete Association
89. NSF National Sanitation Foundation
90. NWMA National Woodwork Manufacturers Association
91. NYSDEC New York State Department of Environmental Conservation
92. NYSDOT New York State Department of Transportation
93. OSHA Occupational Safety and Health Act
94. PCA Portland Cement Association
95. PCI Prestressed Concrete Institute
96. PDI Plumbing and Draining Institute
97. PEI Porcelain Enamel Institute Incorporated
98. PPI Plastics Pipe Institute
99. PRA Public Roads Alphabet
100. RMA Rubber Manufacturers Association
101. SAE Society of Automotive Engineers
102. SDI Steel Door Institute
103. SJI Steel Joist Institute
104. SMACNA Sheet Metal and Air Conditioning Contractors National Association

105. SSPC Steel Structures Painting Council
106. TPI Truss Plate Institute, Inc.
107. UL Underwriters Laboratories, Inc.
108. USSG United States Standard Gauge (for uncoated sheets and thin plates)

B. Where any of the following abbreviations or symbols are used in the Contract Documents, they shall have the meaning set forth opposite each.

1. UNITS OF LINEAR MEASURE
   a. cm. -- Centimeters
   b. in. or " -- Inches
   c. LF, Ft. or ' -- Linear Feet or Feet
   d. Yds. -- Yards
2. UNITS OF SQUARE MEASURE
   a. Sq. cm. -- Square Centimeters
   b. Sq. in. -- Square Inches
   c. Sq. Ft./SF -- Square Feet
   d. SY -- Square Yards
   e. Ac. -- Acres
3. UNITS OF CUBIC MEASURE
   a. Cu. in. -- Cubic Inches
   b. Cu. Ft./CF -- Cubic Feet
   c. CY -- Cubic Yards
4. UNITS OF LIQUID MEASURE
   a. Pt. -- Pint
   b. Qt. -- Quart
   c. Gal. -- Gallon
   d. Bbl -- Barrel
   e. L -- Liter
5. UNITS OF WEIGHT
   a. Oz. -- Ounces
   b. Lb. or # -- Pounds
   c. Cwt -- Hundredweight or 100 pounds
   d. Kip -- 1000 pounds
   e. gm -- Gram
   f. mg -- Milligram
   g. Kg -- Kilogram
6. UNITS OF TEMPERATURE
   a. °F -- Degrees Fahrenheit
   b. °C -- Degrees Centigrade
7. UNITS OF FORCE OR PRESSURE
   a. psi -- Pounds per Square Inch
   b. psia -- Pounds per Square Inch Absolute
   c. psig -- Pounds per Square Inch Gauge
   d. psf -- Pounds per Square Foot
   e. ksi -- Kips per Square Inch
   f. ksf -- Kips per Square Foot
   g. tsf -- Tons per Square Foot
8. UNITS OF VELOCITY/FLOW
   a. ips -- Inches per Second
   b. fpm -- Feet per Minute
   c. mph -- Miles per Hour
   d. rev -- Revolutions
   e. rpm -- Revolutions per Minute
   f. cfs -- Cubic Feet per Second
   g. cfm -- Cubic Feet per Minute
   h. gpm -- Gallons per Minute
   i. mgd -- Million Gallons per Day
9. UNITS OF TIME

a. Sec. -- Seconds
b. Min. -- Minutes
c. Hrs. -- Hours

10. UNITS OF ANGULAR MEASUREMENT
    a. Sec. or " -- Seconds
    b. Min. or ' -- Minutes
    c. Deg. or ° -- Degrees
11. UNITS OF CONCENTRATION
    a. ppm -- Parts per Million
    b. Kg/l -- Kilograms per Liter
    c. mg/l -- Milligrams per Liter
12. UNITS OF POWER
    a. hp -- Horsepower
    b. bhp -- Brake Horsepower
13. MATERIALS
    a. ABS -- Acrylonitrile Butadine Styrene
    b. ACCMP -- Asphalt Coated Corrugated Metal Pipe
    c. ACP -- Asbestos Cement Pipe
    d. BIT -- Bituminous
    e. CIP -- Cast Iron Pipe
    f. CISP -- Cast Iron Soil Pipe
    g. CONC -- Concrete
    h. CPVC -- Chlorinated Polyvinyl Chloride
    i. DIP -- Ductile Iron Pipe
    j. CLDIP -- Cement Lined Ductile Iron Pipe
    k. GLDIP -- Glass Lined Ductile Iron Pipe
    l. HDPE -- High Density Polyethylene
    m. PCCP -- Prestressed Concrete Cylinder Pipe
    n. PE -- Polyethylene
    o. PVC -- Polyvinyl Chloride
    p. RCP -- Reinforced Concrete Pipe
    q. SST -- Stainless Steel
    r. CU -- Copper
    s. TCP -- Terra Cotta Pipe
    t. VCP -- Vitrified Clay Pipe
14. MISCELLANEOUS
    a. B&B -- Balled and Burlapped
    b. BR -- Bare Root
    c. CPM -- Critical Path Method
    d. CTS -- Copper Tube Size
    e. Div. -- Division
    f. ID or OD -- Inside Diameter or Outside Diameter
    g. IPS -- Iron Pipe Size
    h. NPT -- National Pipe Thread
    i. ODS -- Oven Dried Solids
    j. pH -- Measure of Acidity or Alkalinity
15. ELECTRICAL
    a. A -- Amperes
    b. AC -- Alternating Current
    c. DC -- Direct Current
    d. V -- Volts Hz -- Hertz
    e. KvA -- Kilovolt Amperes
    f. KW -- Kilowatts
    g. MA -- Milliamps
16. MECHANICAL
    a. NPSH -- Net Positive Suction Head
    b. TDH -- Total Dynamic Head

c. BTU -- British Thermal Units
d. K -- Thermal Conductivity -- BTU/(hr) (FT2) (Degree F/Ft) (°F/Ft)
e. C -- Thermal Conductance -- BTU/(hr) (FT2) (Degree F) (°F)
f. U -- Coefficient of Heat Transmission -- BTU/(hr) (FT2) (Degree F) (°F)
g. R -- Thermal Resistance -- (hr) (FT2) (Degree F)/BTU (°F)/BTU

PART 2 PRODUCTS

2.01 NOT USED

PART 3 - EXECUTION

3.01 NOT USED

**** END OF SECTION ****

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SECTION 014216
DEFINITIONS

PART 1 GENERAL

1.01 SUMMARY

A. Other definitions are included in individual specification sections.

1.02 DEFINITIONS

A. Furnish: To supply, deliver, unload, and inspect for damage.

B. Install: To unpack, assemble, erect, apply, place, finish, cure, protect, clean, start up, and make ready for use.

C. Product: Material, machinery, components, equipment, fixtures, and systems forming the work result. Not materials or equipment used for preparation, fabrication, conveying, or erection and not incorporated into the work result. Products may be new, never before used, or re-used materials or equipment.

D. Provide: To furnish and install.

E. Supply: Same as Furnish.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SECTION 015000
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary sanitary facilities.

B. Waste removal facilities and services.

C. Project identification sign.

1.02 RELATED REQUIREMENTS

A. Section 015813 - Temporary Project Signage.

1.03 TEMPORARY UTILITIES

A. Owner will provide the following:
   1. Electrical power and metering, consisting of connection to new temporary and permanent service.
   2. Water supply, consisting of new public water connection.

B. Use trigger-operated nozzles for water hoses, to avoid waste of water.

1.04 TEMPORARY SANITARY FACILITIES

A. The Contractor for General Construction shall provide and maintain required facilities and enclosures. Provide at time of project mobilization.

B. Maintain daily in clean and sanitary condition and as further required in Section 011000.

1.05 BARRIERS

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

1.06 FENCING

A. Construction: Commercial grade chain link fence.

B. Provide 6 foot (1.8 m) high fence around construction site; equip with vehicular and pedestrian gates with locks.

1.07 VEHICULAR ACCESS AND PARKING

A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.

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

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

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

E. Provide temporary parking areas to accommodate construction personnel at the location designated by the Owner. When site space is not adequate, provide additional off-site parking.

1.08 WASTE REMOVAL

A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition. Deliver the waste to the Owner's transfer station.

B. Provide containers with lids or traps. Remove trash and litter from site periodically.

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

1.09 PROJECT SIGNS - SEE SECTION 015813

1.10 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection and subject to Engineer.

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

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

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 015213
FIELD OFFICES AND SHEDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary field offices for use of Contractor.

B. Maintenance and removal.

1.02 USE OF PERMANENT FACILITIES

A. Permanent facilities shall not be used for field offices.

PART 2 PRODUCTS

2.01 MATERIALS, EQUIPMENT, FURNISHINGS

A. Materials, Equipment, Furnishings: Serviceable, new or used, adequate for required purpose.

2.02 CONSTRUCTION

A. Portable or mobile buildings, or buildings constructed with floors raised above ground, securely fixed to foundations, with steps and landings at entrance doors.

1. Temporary offices will comply with all Local, State and Federal regulations having jurisdiction.

B. Lighting for Offices: 50 fc (538 lx) at desk top height, exterior lighting at entrance doors.

C. Fire Extinguishers: Appropriate type fire extinguisher at each office.

2.03 ENVIRONMENTAL CONTROL

A. Heating, Cooling, and Ventilating: Automatic equipment to maintain comfort conditions.

2.04 CONTRACTOR OFFICE AND FACILITIES

A. Field office facilities will be the responsibility of each Prime Contractor.

B. Size to be determined.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install office spaces ready for occupancy no later than 10 days after the Notice to Proceed.

3.02 MAINTENANCE AND CLEANING

A. Weekly janitorial services for offices; periodic cleaning and maintenance for offices.

B. Maintain approach walks free of mud, water, and snow.

3.03 REMOVAL

A. At completion of Work remove buildings, foundations, utility services, and debris. Restore areas.

END OF SECTION

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SECTION 015460
PROTECTION OF EXISTING PROPERTY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for protecting existing public and private property on or in the vicinity of the work site and the handling of claims and complaints arising as a result of the work.

1.02 SYSTEM DESCRIPTION

A. Requirements of this section are supplemental to General Conditions Section "Contractor's Responsibilities."

B. Contractor shall take all necessary precautions for the safety of and shall provide the necessary protection to prevent damage, injury or loss to all public and private property not designated for removal, relocation or replacement in the course of construction. The Contractor shall not damage or disturb existing or future structures adjacent to the construction easement.

C. During construction, if it is necessary to temporarily remove any existing services, they shall be reconnected the same day or temporary services shall be provided. Affected owners shall be notified 48 hours prior to disruption of service.

D. Contractor shall protect the natural vegetation and other existing landscape features and surroundings. Where practical, trees shall be protected to the drip-line as shown in the Standards for Soil Erosion and Sediment Control as published by the State Soil Conservation Committee. If damage occurs to a tree's root system within the drip-line, the tree shall be pruned accordingly using accepted tree surgery techniques to compensate for the loss of root system. Damages to tree trunks, limbs, bark and roots shall be repaired using accepted tree surgeon methods.

E. All grass areas beyond the construction limits damaged by the Contractor shall be repaired using seeding methods and materials equal to or better than that which existed prior to construction.

F. Where damage or injury or loss is done to public or private property as a result of

G. the Contractor's execution of the work, such property shall be restored by the Contractor at his expense to a condition equal to or better than that existing prior to the damage.

H. Where property has existing damages that cannot be clearly verified by the preconstruction photographs or video tapes previously submitted, the nature and extent of such damages shall be documented and submitted to the Engineer prior to any construction or construction related activity.

I. Damages to curbs, sidewalks, driveways, lawns, shrubbery, property, monuments or other property that are not documented as pre-existing and do not show on the preconstruction photographs or video tapes, will be viewed as a result of the Contractor's execution of the work and shall be repaired in a manner acceptable to the Engineer. The Contractor shall, at his own expense, take such additional photographs as may be required to document damage which exists prior to construction.

1.03 QUALITY ASSURANCE

A. Survey markers removed or disturbed by the Contractor's Operations shall be reset by a Licensed Land Surveyor registered in the State of the project. Such surveyor shall certify to the Owner that reset markers are located at the same location and/or elevation as they were prior to their removal or disturbance.

B. The Contractor shall expeditiously and satisfactorily resolve all claims and complaints arising as a result of work under this Contract. The Contractor shall provide the services of an authorized representative during normal working hours for the purpose of handling all such claims and complaints. A file shall be maintained to log all claims and complaints and shall include the date and time, person filing the claim or complaint, nature and extent of the claim or complaint, and its resolution. The Contractor must advise the owner monthly in writing of all such claims and complaints received by him including the status of each and for each claim or complaint that has been secured by his insurance company, proof that such has been done.

C. The Contractor shall pay for all costs to handle and resolve all claims or complaints. If within 30 days of receipt of a complaint, the Contractor fails to settle or secure any claim or complaint, the owner may retain such amounts of money from payments that would otherwise be due the Contractor as, in the opinion of the owner, may be required to settle all claims filed with the owner.

1.04 SUBMITTALS

A. The Contractor will submit to the Engineer lists of damages to property that exist immediately following the Notice to Proceed and if concealed, prior to the construction or construction related activity. The list shall include the following information:
   1. Location of damage by station or address
   2. Nature of damage
   3. Extent of damage
   4. Color photographs of damage
   5. Lists shall be submitted sufficiently in advance in order that the Engineer can verify the damages.

PART 2 PRODUCTS

2.01 NOT USED

PART 3 - EXECUTION

3.01 NOT USED

**** END OF SECTION ****

SECTION 015610
NOISE CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for controlling noise levels resulting from construction activities.

1.02 SYSTEM DESCRIPTION

A. The Contractor shall control the noise generated by his construction operations.

B. Noise caused by construction activities shall not exceed the levels permitted by applicable Federal, State or local regulations.

C. All construction equipment powered by an internal combustion engine shall be equipped with a properly maintained muffler.

D. Air compressors shall be operated in accordance with the manufacturer's instructions for proper noise abatement.

E. Air powered equipment shall be fitted with pneumatic exhaust silencers.

F. Stationary equipment powered by an internal combustion engine shall not be operated within 150 feet of noise sensitive sites without temporary noise barriers placed between the equipment and the noise sensitive sites. Noise sensitive sites shall include residential buildings, motels, hotels, schools, churches, hospitals, nursing homes, libraries and public recreation areas. Temporary noise barriers shall be constructed of plywood or tongue and groove boards with a noise absorbent treatment on the interior surface (facing the equipment).

G. Unless otherwise permitted by the owner in times of an emergency, powered construction equipment shall not be operated beyond the Owner's permitted operating hours or the locale applicable ordinance.

H. Unless otherwise permitted by the owner in times of an emergency, driving, pulling or other operations entailing the use of vibratory hammers or use of vibratory compactor shall not be permitted before 8:00 am or after 5:00 pm within 100 feet of a noise sensitive site.

PART 2 - PRODUCTS

2.01 NOT USED

PART 3 - EXECUTION

3.01 NOT USED

**** END OF SECTION ****

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SECTION 015680
EROSION CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for controlling erosion as a result of the work.

1.02 SYSTEM DESCRIPTION

A. Contractor shall control erosion of earth and sediment runoff resulting from the work. Erosion control measures shall comply with the publication “New York Standards and Specifications for Erosion and Sediment Control”.

B. Erosion as a result of surface drainage from cuts and fills within the construction limits, whether or not completed, and from staging, stockpile, borrow and waste disposal areas, shall, if turbidity producing materials are present, be held in suitable sedimentation basins or shall be graded to control erosion. Temporary erosion and sediment control measures including but not limited to berms, dikes, drains, soil stabilization matting, diversion channels, baled hay or straw, silt fences, catch basin protection, and sedimentation basins, shall be provided and maintained as required to meet the referenced standards.

C. Along slopes and designated critical erosion or siltation areas, clearing and grubbing operations shall be delayed until absolutely necessary for the continuation of the work so that the area of exposed, bare soil subject to erosion is minimized.

D. All temporary erosion control measures shall be in place prior to any grading or excavation operations and shall be left in place or replaced as required to retain their desired effectiveness until the construction is completed and the area is stabilized.

E. All excavated material, when excavating parallel to streams, wetland habitats, and other critical impact areas, shall be deposited on the up-slope side of the excavation.

F. Stockpiled material shall not have side slopes in excess of 3:1. Stockpiled material shall be protected form erosion by the use of mulch, jute netting, grass seeding, hay bales, or similar material.

G. Contractor shall select stockpile areas in areas where a minimum of erosion sediment will reach catch basins, streams, lagoons or other receiving systems. Only environmentally suitable stockpile sites shall be used for the purpose of storing materials, equipment and spoils. Suitable sites shall be level, devoid of mature stands of natural vegetation, and removed from drainage facilities and features, wetlands and stream corridors. Protect stockpile areas from erosion by wind or water.

H. Contractor shall periodically during construction remove sediment from all receiving systems where material has been deposited as a result of his operations in the performance of the work. Upon completion of the work, all affected areas shall be restored.

I. Contractor shall submit intended plans for erosion and sediment control at the preconstruction conference.

J. Whenever excess excavated material is disposed of on private lands, the Contractor shall obtain a statement from the land owner that the land owner has been apprised by the Contractor of the erosion control requirements and accepts complete responsibility for their implementation.

1.03 REFERENCES

A. Latest revision of New York Standards and Specifications for Erosion and Sediment Control.

PART 2 PRODUCTS

2.01 NOT USED

PART 3 EXECUTION

3.01 NOT USED

**** END OF SECTION ****

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SECTION 015700
MAINTENANCE AND PROTECTION OF TRAFFIC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for the furnishing, installing, maintaining and removing, when no longer required, of all traffic control devices necessary for the maintenance and protection of pedestrian and vehicular traffic.

1.02 SYSTEM DESCRIPTION

A. The Contractor shall keep the portion of the project being used by public traffic, whether it be through or local traffic, in such condition that pedestrian and vehicular traffic will be adequately and safely accommodated, both temporarily and permanently. The Contractor shall erect, and/or maintain in good condition, striping, barricades, signs, lights, traffic signals, cones, and other warning and danger signals and devices, including flagmen and uniformed traffic directors, appropriate and adequate for the specific needs and as specified in the Federal Manual of Uniform Traffic Control and the NYSDOT Supplement to the Federal Manual of Uniform Traffic Control. Traffic control devices are to be provided at work sites, closed roads, intersections, open excavations, locations of material storage, standing equipment and other obstructions, at points where usable traffic width of road is reduced, at points where traffic is diverted from its normal course or lanes, and other places of danger to vehicular or pedestrian traffic.

B. The requirements of the agency having jurisdiction over the roadways in which the contractor is working shall govern. If the governing jurisdiction does not feel that the contractor is meeting the required traffic control as set forth in the Federal and New York State Department of Transportation Supplemental manual, all work shall be stopped until the contractor complies. This shall not entitle the contractor to a time extension or claim for delays.

C. The contractor shall provide access for police, fire, ambulance, bus and emergency vehicles and personnel at all times on all roads in which the Contractor is working.

D. The Contractor may be required to provide, in addition to flagmen, uniformed traffic officers to fulfill the expressed needs of the municipality or any governmental agency having jurisdiction.

E. If the Contractor reroutes traffic over detours, he shall first obtain authorization of the Engineer and consent of the appropriate authorities having jurisdiction. The Contractor shall make all necessary arrangements with such authorities regarding the establishment, maintenance and repair of such detours, the regulation and direction of traffic thereon, and signing. Adequate directional and detour signs, acceptable to the appropriate authorities, shall be furnished by the Contractor and shall be erected by him at locations where such authorities may direct.

F. When the construction of a detour is provided for in the drawings or requested by the jurisdictional authority, the Contractor shall furnish and erect all necessary signs, barricades, lights and other warning and danger signals and devices.

G. During any suspension of the work, the Contractor shall make passable, and shall open to traffic such portions of the project and temporary roadways or portions thereof, as may be agreed upon between the Contractor, the Engineer and the jurisdictional authority for the temporary accommodation of necessary traffic during the anticipated period of suspension. When work is resumed, the Contractor shall replace or renew all work or materials lost or damaged because of such temporary use of the project and shall complete the project in every respect as though its prosecution had been continuous and without interference.

H. Prior to beginning construction work in any area or phase of the project, the Contractor shall erect or place those barricades, lights, signs, cones and other warning and danger signals and devices which are adequate and appropriate for that particular area or phase. Traffic control devices shall conform to the drawings and specifications and to the Manual of Uniform Traffic Control Devices (MUTCD) of the Federal Highway Administration and NYSDOT Supplement to the Federal MUTCD.

I. All signs shall be erected and maintained in a substantial manner and shall be maintained so as to provide maximum visibility and legibility at all times.

1.03 REFERENCES

A. NYSDOT Standard Specifications.

B. NYSDOT Supplement to the Federal Manual of Uniform Traffic Control Devices.

C. Manual on "Uniform Traffic Control Devices for Streets and Highways," U. S. Department of Transportation, Federal Highway Administration.

1.04 SUBMITTALS

A. The Contractor shall notify the owners of adjoining property in writing at least 24 hours prior to the time he proposes to begin any work which will interfere with their normal passage.

B. The Contractor shall notify the Engineer and the jurisdictional authority ten working days in advance of a tentative date for establishing new traffic patterns. This date shall be finalized five working days prior to the establishment of new traffic patterns resulting from staged construction and five working days prior to the establishment of a detour for the closing of any roadway.

C. Review by the Engineer of the Contractor's traffic control system shall in no way relieve the Contractor from his full responsibility for the maintenance and protection of traffic.

D. Shop Drawings shall be submitted by the Contractor in accordance with the provisions of the Section "Shop Drawings and Samples," Division 1.

1.05 PROJECT CONDITIONS

A. Except as necessary during actual working hours, and then only with the specific authorization of the Engineer or jurisdictional authority, the Contractor shall not occupy with his equipment, materials, or personnel, any roadway or sidewalk area within or adjacent to the project that is open to traffic.

B. No equipment or machinery having caterpillar or other heavy treads that mar or damage pavements shall be permitted to move over or operate from newly constructed or existing pavements unless such equipment or machinery is moved on suitable pontoons or trailers or operated on heavy planing or other suitable platforms.

C. The Contractor shall provide for prompt removal from existing roadways of all dirt and other materials that have been spilled, washed, tracked or otherwise deposited thereon by his hauling and other operations whenever the accumulation is sufficient to cause the formation of mud, interfere with drainage, damage pavements, create a traffic hazard or dust condition.

D. The Contractor shall cease work on existing roads when snow is imminent. The Contractor is responsible for snow removal on any roads on which he is working. He shall, however, park his equipment in such a manner as not to hinder the removal of snow by other agencies. The Contractor shall make suitable provisions to mark the location of equipment and all other obstructions in the event of deep snow.

PART 2 PRODUCTS

2.01 MATERIALS

A. Barricade, Type IIIA: Materials and construction shall be as specified in the Manual of Uniform Traffic Control Devices. Lighting shall be placed and maintained as required.

B. Drums: Materials shall be as specified in the Manual of Uniform Traffic Control Devices. Each drum when used to delineate the edge of a traveled way on detour curves, lane changes, lane closures and other similar conditions shall be lighted with a steady burning light as hereinafter specified. All drums used at other locations shall be lighted with a low intensity flashing warning light. Drums shall be clean, bright and reflectorized.

C. Traffic Cones: Material and construction shall be as specified in the Manual of Uniform Traffic Control Devices. Cones shall be kept clean and bright for maximum target value. Traffic cones shall be reflectorized or equipped with steady burning lights when used during the hours specified below for steady burning lights. Cones shall be painted orange. Rubber cones shall be painted at the place of manufacture. Plastic cones shall be polyvinyl chloride with the color molded into the plastic.

D. Barricade, Type I: Material and construction shall be as specified in the Manual of Uniform Traffic Control Devices. Barricade, Type I shall be lighted with low intensity flashing warning lights.

E. Breakaway Barricades: Materials and construction shall be as specified in the Manual of Uniform Traffic Control Devices. Breakaway Barricades shall be lighted with low intensity flashing warning lights.

2.02 LIGHTING SPECIFICATIONS

A. General: Storage batteries or other bulk power sources, not part of a monolithic flasher unit shall be located as far as practical from the traveled way and at ground level. Single flasher and steady burning units with self-contained batteries shall weigh not more than seven pounds and when located on traffic control devices shall be securely fastened with the bottom tangent of the lens at 36" above the existing ground level. Battery powered dual alternate flashers located on advance warning signs shall have the battery power source located as far as practical from the traveled way and at ground level.

B. Steady burning lights: Steady burning lights shall be installed on traffic control devices where specified elsewhere herein. Steady burning lights shall be low wattage yellow electric lamps having a minimum of ten beam candle power. They may be self-contained units with a batteries or may be operated with a portable electric generator or from available utility lines. When a circuit in excess of fifty volts is used and such circuits including the light units are within reach of a person who can make contact with the ground, they shall be equipped with a UL approved ground-fault circuit interrupter. Steady burning lights when used where specified shall be kept lighted from one hour before sunset until one hour after sunrise, and through all hours of fog, smog, and other adverse atmosphere conditions affording insufficient visibility for the safe operation or traffic.

C. Low Intensity Flashing Warning Lights: Low intensity flashing warning lights shall be installed on traffic control devices where specified elsewhere herein. Low intensity lights shall be battery operated yellow flashing lights with a one piece lens not less than seven inches in diameter. They shall flash at a rate of 55-75 flashes per minute and the flash duration shall be ten percent of each flash cycle. Light intensity shall not drop below than candelas during the first 336 hours of continuous flashing as specified in ITE Standards Requirement 5.0, Paragraph 5.10, Section 1 of the ITE Standards for Flashing and Steady Burn Barricade Warning Lights. The lens shall be externally illuminated by reflex elements built into the lens to be seen by reflex-reflection of the light from the headlights of oncoming automotive traffic. Intensity when acting as a reflex-reflector shall be as in ITE Standard Requirement 5, Paragraph 5.50. If designed with a reflex reflector ring, the ring shall not be less than ½" in width around the periphery of the lens. Manufacturing design requirements shall conform to the ITE Standard. Low intensity flashing warning lights when used where specified shall be kept lighted as specified for steady burning lights.

2.03 CONSTRUCTION SIGNS

A. The type, size, legend, color, illumination, location, number and shape of construction signs shall be in accordance with the MUTCD.

B. The number and construction of sign supports shall be as shown on the drawings unless otherwise directed by the jurisdictional authority.

C. PAVEMENT MARKINGS

D. Pavement markings shall be ready-mixed white or yellow traffic paints, fast dry, with glass beads applied for nighttime visibility with the composition as described in the NYSDOT Standard Specifications.

PART 3 EXECUTION

3.01 ERECTION

A. As a minimum the Contractor shall erect, maintain and replace as necessary, the required signs for each direction of traffic on all private, municipal, county or state roadways affected by the project. The signs shall bear no symbols or messages except as specified. The sign supports shall carry no other signs not essential to traffic control.

3.02 INSTALLATION

A. Barricade, Type IIIA: When a road section is closed to traffic, Type IIIA Barricades shall be erected at points of closure. They may extend completely across a roadway and its shoulder or from curb-to-curb. Where provisions must be made for access of equipment and authorized vehicles, the Type IIIA barricades should be provided with gates or movable sections that can be closed when work is not in progress, or with indirect openings that will discourage public entry. Where access is provided through the Type IIIA barricades, responsibility shall be assigned to a person to assure proper closure at the end of each working day. When a road is legally closed, but access must still be allowed for local traffic, the Type IIIA barricade cannot be erected completely across a roadway. Instead, an arrangement should be devised that will permit local use but effectively discourage use by through traffic. The use of Type IIIA barricade in areas where contact with public vehicular traffic is possible must be approved by the Engineer and/or the jurisdictional authority.

B. Drums: Drums shall generally be used to delineate the edge of a traveled way on detour curves, lane changes, lane closures and other similar conditions such as to channel traffic. Drums may also be used to mark specific hazards.

C. Traffic Cones: Traffic cones shall generally be installed to channel traffic.

D. Barricade, Type I: Type I barricades are intended for use in situations where traffic is maintained through the area being constructed and/or reconstructed. They may be used singly or in groups to mark a specific hazard or they may be used in a series for channeling traffic. Type I barricades would normally be used on conventional roads or urban streets and arterials.

E. Breakaway Barricades: Breakaway barricades shall be used as a warning and a delineation device at the edge of the traveled way.

F. Pavement Markings: Pavement markings, both permanent and temporary, shall be constructed in accordance with the MUTCD. Where maintenance of traffic or construction staging require the use of traffic stripes for relatively short and temporary periods, striping of pavements and base courses shall be accomplished before opening to traffic. Where traffic stripes are to be provided on the final surface of the pavement, the stripes shall be placed before the pavement is opened to traffic. The contractor shall maintain the traffic stripes in good condition at all times. When no longer required, all temporary traffic stripes shall be removed from the pavement by use of appropriate brush and detergents or by other means approved by the jurisdictional authority.

G. Uniformed Traffic Directors: Uniformed traffic directors shall be provided when and where called for in the specifications or as directed by the jurisdictional authority and authorized by the Engineer. The Contractor shall, with the permission of the respective Police Department, secure the services of uniformed police officers to direct traffic in those parts of the project under the jurisdiction of the respective municipality. These directors shall be responsible and trained in their duties to direct pedestrian and vehicular traffic, shall act in conformance with Police Department requirements and while serving as traffic directors on this project, shall not be required to perform any other duties. When controlling traffic, uniformed traffic directors shall follow the procedures stipulated for flagmen in the MUTCD.

H. FLAGMEN: FLAGMEN PROVIDED BY THE CONTRACTOR WHO ARE NORMALLY HIRED TO DO OTHER WORK ON THE PROJECT DURING THE SAME WORK PERIOD, SHALL NOT BE CONSIDERED AS UNIFORMED TRAFFIC DIRECTORS. FLAGMEN SHALL BE PROVIDED WHEN AND WHERE CALLED FOR IN THE SPECIFICATIONS OR AS DIRECTED BY THE JURISDICTIONAL AUTHORITY AND AUTHORIZED BY THE ENGINEER. FLAGMEN SHALL BE TRAINED AND OF AVERAGE INTELLIGENCE, GOOD PHYSICAL CONDITION, INCLUDING SIGHT AND HEARING, HAVING A MENTAL ALERTNESS, A COURTEOUS BUT FIRM MANNER, NEAT APPEARANCE AND SENSE OF RESPONSIBILITY FOR THE SAFETY OF THE PUBLIC. FLAGMEN SHALL WEAR AN ORANGE VEST. THIS GARMENT SHALL BE REFLECTORIZED FOR NIGHTTIME OPERATIONS.

**** END OF SECTION ****

SECTION 015813
TEMPORARY PROJECT SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project identification sign.

B. Project informational signs.

1.02 QUALITY ASSURANCE

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

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

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

PART 2 PRODUCTS

2.01 SIGN MATERIALS

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

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

C. Rough Hardware: Galvanized.

D. Lettering: Pre-cut vinyl self-adhesive products, white.

2.02 PROJECT IDENTIFICATION SIGN

A. One painted sign, 32 sq ft (2.98 sq m) area, bottom 6 feet (2 m) above ground.

B. Content:
   1. Project number, title, logo and name of Owner as indicated on Contract Documents.
   2. Names and titles of Engineer and Consultants.
   3. Names of Prime Contractors.

C. Graphic Design, Colors, Style of Lettering: Designated by Engineer.

2.03 PROJECT INFORMATIONAL SIGNS

A. Provide warning signs, alternately affixed to construction fence:
   1. Hard Hat Area
   2. Posted: Keep Out
   3. DANGER: Construction Area
   4. Construction Personnel Only; PPE Required

PART 3 EXECUTION

3.01 INSTALLATION

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

3.02 MAINTENANCE

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

3.03 REMOVAL

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

END OF SECTION

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SECTION 016000
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Transportation, handling, storage and protection.

B. Product option requirements.

C. Substitution limitations.

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

1.02 RELATED REQUIREMENTS

A. Section 012500 - Substitution Procedures: Substitutions made during procurement and/or construction phases.

B. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions: Requirements for VOC-restricted product categories.

C. Section 017419 - Construction Waste Management and Disposal: Waste disposal requirements potentially affecting product selection, packaging and substitutions.

1.03 SUBMITTALS

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

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

C. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
   1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 PRODUCTS

2.01 NEW PRODUCTS

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

B. Where other criteria are met, Contractor shall give preference to products that:
   1. If used on interior, have lower emissions, as defined in Section 016116.
   2. If wet-applied, have lower VOC content, as defined in Section 016116.

2.02 PRODUCT OPTIONS

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

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

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

2.03 MAINTENANCE MATERIALS

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

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

PART 3 EXECUTION

3.01 SUBSTITUTION LIMITATIONS

A. See Section 012500 - Substitution Procedures.

3.02 TRANSPORTATION AND HANDLING

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

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

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

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

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

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

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

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

3.03 STORAGE AND PROTECTION

A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 017419.

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

C. Store with seals and labels intact and legible.

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

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

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

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

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

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

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

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

END OF SECTION

SECTION 016200
PRODUCT DELIVERY, STORAGE AND HANDLING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for properly delivering, storing and handling products.

1.02 SYSTEM DESCRIPTION

A. Products shall be delivered, stored and handled in a manner that will assure preservation of quality and fitness for incorporation in the work.

B. As and if required products shall be protected from the elements during storage by providing sheltered, weather-tight enclosures. Skids or platforms shall be provided for products subject to damage by contact with ground.

C. Packaged materials shall be stored in their original packages or containers with weather resistant tags identifying the package contents, manufacturer's name and Contractor's name.

D. Copies of all delivery tickets, vendor tickets, bills of lading and other records shall be given to the Engineer at the time of delivery and shall contain the name of supplier, material delivered, quantity of material, date of delivery and project name.

E. If partial payments have been made for products or equipment suitably stored off-site, the Contractor shall provide certificates of insurance for full replacement value of the products or equipment.

F. Unless otherwise specified, the Contractor shall provide insurance to hold harmless the Owner and Engineer against liability claims and judgements or demands for damages arising from accidents to persons or property occasioned by transportation, handling and storage or products or equipment. A certificate shall be provided prior to shipping.

G. The Contractor shall comply with manufacturer's recommendations concerning periodic maintenance requirements for items stored for extended periods.

H. Equipment or materials shall not be stored on the site in such a manner as to interfere with the Owner's operation, create obstructions that would endanger the public, or interfere with the work. Equipment and material shall not be stored within 100 feet of any intersection, or on any sidewalks.

I. Pipe, manholes, appurtenances, backfill material, stone, select materials, and all other construction materials shall not be stored or stockpiled on public thoroughfares or adjoining rights-of-way more than one day in advance of their intended incorporation into the work. In no case shall any material be stored or stockpiled outside of the rights-of-way or easements or on private property without the written permission of the property owner.

PART 2 PRODUCTS

2.01 NOT USED

PART 3 EXECUTION

3.01 NOT USED

**** END OF SECTION ****

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SECTION 016510
CONNECTION TO EXISTING UTILITIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for connecting to existing utility systems.

1.02 SYSTEM DESCRIPTION

A. The Owner, Engineer and Utility Owner shall be notified 48 hours in advance of all tie-ins to existing utility systems.

B. All new utility services requiring connection to existing utility systems shall remain isolated from the existing utility until all required tests have been satisfactorily complied with and if required, the service has been inspected and approved by the respective utility owner.

C. All materials and construction methods used for the connection to an existing utility and the requirements for protecting the same shall comply with the respective utility company's requirements.

1.03 SUBMITTALS

A. Prior to construction, the proposed method of connection and list of materials to be used for the necessary utility connections shall be submitted in accordance with the requirements of Division 1.

PART 2 PRODUCTS

2.01 NOT USED

PART 3 EXECUTION

3.01 NOT USED

**** END OF SECTION ****

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SECTION 017000
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Cutting and patching.

C. Surveying for laying out the work.

D. Cleaning and protection.

E. Starting of systems and equipment.

F. Demonstration and instruction of Owner personnel.

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

H. General requirements for maintenance service.

1.02 RELATED REQUIREMENTS

A. Section 017900 - Demonstration and Training: Demonstration of products and systems to be commissioned and where indicated in specific specification sections

B. Section 078400 - Firestopping.

1.03 QUALIFICATIONS

A. For surveying work, employ a land surveyor registered in the State in which the Project is located and acceptable to Engineer. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities,

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

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

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

C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 016000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

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

1. Each Contractor will become familiar with the Engineers Geo-Technical support attached to the specifications.

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

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

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

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

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

3.02 PREPARATION

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

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

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

3.03 LAYING OUT THE WORK

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

B. Promptly notify Engineer of any discrepancies discovered.

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

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

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

F. Utilize recognized engineering survey practices.

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

H. Periodically verify layouts by same means.

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

3.04 GENERAL INSTALLATION REQUIREMENTS

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

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

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

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

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

3.05 CUTTING AND PATCHING

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

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

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

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

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

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

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

H. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 078400, to full thickness of the penetrated element.

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

3.06 PROGRESS CLEANING

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

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

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

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

3.07 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

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

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

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

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

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

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

3.08 SYSTEM STARTUP

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

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

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

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

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

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

3.09 DEMONSTRATION AND INSTRUCTION

A. See Section 017900 - Demonstration and Training.

3.10 ADJUSTING

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

B. Testing, adjusting, and balancing HVAC systems: See Section 230593 - Testing, Adjusting, and Balancing for HVAC.

3.11 FINAL CLEANING

A. Execute final cleaning prior to final project assessment.
   1. Clean areas to be occupied by Owner prior to final completion before Owner occupancy.

B. Use cleaning materials that are nonhazardous.

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

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

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

F. Clean filters of operating equipment.

G. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, and drainage systems.

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

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

3.12 CLOSEOUT PROCEDURES

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

B. Notify Engineer when work is considered ready for Engineer's Substantial Completion inspection.
   1. Competent individual shall accompany Architect and shall have authority to promptly direct corrective measures.
   2. Have sufficient craftspeople on hand at time of walk through to immediately begin corrective work.

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

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

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

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

G. Complete items of work determined by Engineer listed in executed Certificate of Substantial Completion.

3.13 MAINTENANCE

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

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

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

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

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

END OF SECTION

SECTION 017103
PROHIBITED CONSTRUCTION PROCEDURES

PART 1-GENERAL

1.01 SECTION INCLUDES

A. Requirements for prohibiting the following construction procedures.

1.02 SYSTEM DESCRIPTION

A. Prohibited construction procedures for all parts of the work include, but are not limited to, the following:
   1. Dumping of spoil material into any stream corridor, any wetlands, any surface waters, or at unspecified locations.
   2. Indiscriminate, arbitrary or capricious operation of equipment in any stream corridors, any wetlands, or any surface waters.
   3. Pumping of silt-laden water from trenches or other excavations into any surface waters, any stream corridors, or any wetlands.
   4. Damaging vegetation adjacent to or outside of the access road or right- of-way.
   5. Disposal of trees, brush, and other debris in any stream corridors, any wetlands, any surface waters, or at unspecified locations.
   6. Permanent or unspecified alteration of the flow line of the stream.
   7. Open burning of debris.
   8. Applying any pesticides, including defoliants, desiccants, and plant regulators, in any wetlands.
   9. Applying pesticides whose residues and metabolic products persist in the environment over extended periods of time.
   10. Locating storage, stockpile, staging and de-watering controls in environmentally sensitive areas.
   11. Disposal of excess excavation material in wetlands, stream corridors and flood plains.
   12. Permission or other arrangements with a land owner or others shall not relieve the Contractor of compliance with the requirements of this section.
   13. Any violation of the requirements of this section by the Contractor or any person employed by him will be brought to the immediate attention of the responsible regulatory agencies with a request that appropriate action be taken against the offending parties. Further, the Contractor will be required to remedy any violation at his own expense.

PART 2 - PRODUCTS

2.01 NOT USED

PART 3 - EXECUTION

3.01 NOT USED

**** END OF SECTION ****

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SECTION 017104
CUTTING AND PATCHING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements pertaining to cutting and patching as required to perform the work.

1.02 SYSTEM DESCRIPTION

A. The work includes cutting and patching as required for the removal or installation of equipment, correcting damaged concrete or masonry surfaces and for modifications to existing structures as shown on the drawings and as specified herein..

B. Patching, replacing and refinishing of concrete and masonry work shall match the adjoining work.

C. Unused openings left by removal of piping, conduit, duct and equipment, or portions disturbed during the work, shall be patched.

D. New concrete work shall be made integral with the existing concrete as shown on the drawings and in accordance with the Section "Cast in Place Concrete," Division 3.

E. Existing concrete that has been or is in contact with sewage, shall be sandblasted to a grease free condition before applying the bonding compounds. Bonding compounds shall be applied as described in the Section "Cast in Place Concrete," Division 3.

F. Exposed existing reinforcing bars shall be cleaned by wire brushing before connecting to new bars. New reinforcing bars shall be capped or welded or as shown on the drawings.

G. Where portions of existing structures and equipment are to be removed and where the remaining concrete shall be finished smooth, the Contractor shall cut off any projecting reinforcing to provide at least one inch of cover over the existing reinforcement. The concrete shall be roughened and a bonding compound applied to the existing concrete as described in the Section "Cast In Place Concrete," Division 3. Cement mortar shall be placed in excess of the finished surface and steel troweled flush with the adjacent surface.

H. When concrete is cut to provide openings for new pipe gate stems, or other penetra-tions, pipe sleeves shall be accurately installed and grouted in place.

I. Before patching, embedded conduits, pipes and other embedded items left in place shall be cut to at least two inches into the wall, floor or ceiling.

1.03 SUBMITTALS

A. The Contractor shall submit a written request to the Engineer before cutting or executing alteration work which affects the following:
   1. Owner's operation;
   2. Structural value or integrity of any element of the project;
   3. Integrity or effectiveness of weather-exposed or moisture-resistant elements or systems;
   4. Efficiency, operational life, maintenance or safety of operational elements; or,
   5. Visual qualities of sight-exposed elements.
   6. Operability of the fire protection system.

B. The submittal request shall include but not be limited to the following:
   1. Description of affected work;
   2. The necessity for cutting, alteration or excavation;
   3. Effect on owner's operation or on structural or weatherproof integrity of project; and,
   4. Hot WOrk procedures and compliance with Hot Work Permit. as applicable.
   5. Fire Watch procedures, as applicable.

C. Description of proposed work:
   1. Scope of cutting, patching, alteration, or excavation.
   2. Products proposed to be used.
   3. Extent of refinishing to be done.

D. Submittals shall be in accordance with the Sections "Shop Drawings and Samples," Division 1 and "Review of Contractor's Construction Procedures," Division 1.

PART 2 -PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Concrete Bonding Compounds: As specified in the Contract Documents or as approved by the Engineer.

2.02 MATERIALS

A. Materials for patching and restoration of surfaces shall match the adjoining work and shall be as specified in the respective sections of these specifications.

PART 3 EXECUTION

3.01 INSPECTION

A. Inspect existing conditions of project, including elements subject to damage or to movement during cutting and patching.

B. After uncovering work, inspect conditions affecting installation of products, or performance of work.

C. Report unsatisfactory or questionable conditions to Engineer in writing.

3.02 PREPARATION

A. Provide adequate temporary support as necessary to assure structural value or integrity of affected portion of work.

B. Provide devices and methods to protect other portions of project from damage.

C. Provide protection from elements for that portion of the project which may be exposed by cutting and patching work, and maintain excavations free from water.

3.03 INSTALLATION

A. Execute cutting and demolition by methods which will prevent damage to other work, and will provide proper surfaces to receive installation of repairs or new work.

B. Execute excavating and backfilling by methods which will prevent settlement or damage to the work.

C. Execute fitting and adjustment of products to provide finished installation to comply with specified products, functions, tolerances and finishes.

D. Restore work which has been cut or removed; install new products to provide complete work in accordance with requirements of contract documents.

E. Fit work airtight to pipes, sleeves, ducts, conduit and other penetrations through surfaces.

**** END OF SECTION ****

SECTION 017105
UTILITIES - NOTIFICATION AND MARK OUT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for notifying utility owners and marking out existing utilities on the site.

1.02 SYSTEM DESCRIPTION

A. Contractor shall be responsible for protection of underground facilities in accordance with 16 NYCRR Part 753.

B. Prior to construction, contractor shall call the UFPO, and notify in writing owners of utilities and structures within the vicinity of the proposed work. Copies of written notification to utility owners shall be submitted to the engineer.

C. Contractor shall provide the engineer with a list of all owners of utilities and structures contacted, including the time and date of contact and the names of responsible individuals contacted.

D. Contractor shall be responsible for full mark out of existing utilities and structures sufficiently in advance of the work to allow for a field evaluation of the routing of the work. Contractor shall not proceed with work where utilities have not been located and marked by utility companies or others.

E. The contractor shall maintain the mark out of existing utilities and structures until the work in the vicinity of the marked-out utilities and structures has progressed sufficiently in advance thereof that their location is no longer required.

1.03 SITE CONDITIONS

A. The locations of all utilities and structures as shown on the drawings are based on the best information available, but neither the owner nor the engineer guarantee the accuracy or completeness of the data.

B. Other utilities and structures may exist within the construction site in addition to those shown on the drawings.

C. House/building service utility lines may or may not be shown on the drawings. The contractor shall be responsible for checking these services as to actual locations and possible interferences.

PART 2 PRODUCTS

2.01 NOT USED

PART 3 EXECUTION

3.01 NOT USED

**** END OF SECTION ****

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SECTION 017420
WASTE MATERIALS DISPOSAL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for collecting and disposing waste materials encountered in or resulting from the work.

1.02 SYSTEM DESCRIPTION

A. Waste material common to construction shall include but not be limited to the following:
   1. Solid waste: Equipment and materials resulting from demolition or restoration work, large pieces of asphalt or concrete, trees, stumps, bricks, wire, fences, drums, rubbish and construction debris generated by construction activities and rubble and excess excavated material.
   2. Liquid or semi-liquid waste: Cleanings from settling tanks, digesters, lagoons, basins, manholes, sewer mains, and channels including grit, sludge, scum and miscellaneous debris.
   3. Contractor shall collect and promptly dispose of all waste materials in the project site. Clean-up shall be done and maintained on a daily basis.
   4. All materials and equipment which are not designated as re-usable or salvageable by the owner shall become the property of the Contractor. However, all materials and equipment designated as re-usable or salvageable by the owner shall be carefully removed so as to cause minimum damages and safely stored by the Contractor until accepted by the owner.
   5. Waste materials shall not be burned or buried on the work site.
   6. On contained work sites such as treatment plants or pumping stations, containers suitable for the collection and disposal of waste shall be provided by the Contractor. On transport piping contracts, collection and disposal shall be a continuous function. The Contractor shall remove all waste materials before moving to other sections of the work.
   7. Waste materials shall be disposed of at the Owner's tranfer station.
   8. Waste materials shall be transported by vehicles properly licensed to transport waste by the New York State Department of Environmental Conservation.
   9. Disposal of waste materials shall also conform to the applicable requirements of the Sections "Prohibited Construction Procedures" and "Erosion Control", Division 1.

PART 2 PRODUCTS

2.01 NOT USED

PART 3 EXECUTION

3.01 NOT USED

**** END OF SECTION ****

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SECTION 017800
CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

A. Section 013000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.

1.02 SUBMITTALS

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

B. Operation and Maintenance Data:
   1. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
   2. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Engineer comments. Revise content of all document sets as required prior to final submission.
   3. Submit two sets of revised final documents in final form within 10 days after final inspection.

C. Warranties and Bonds:
   1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
   2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
   3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

D. Additional materials for stock
   1. Provide minimum of 10% extra material or as specified in subsequent sections, whichever is greater.
      a. For each interior finish material.

END OF SECTION

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SECTION 022100
PROJECT SURVEY AND STAKEOUT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. The work shall include, but shall not be limited to, stakeout, progress surveys, and as-built surveys of work items as required to construct all elements of the project as shown on the Drawings and as specified herein.

1.02 SUBMITTALS

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

B. As-built survey of all constructed work

PART 2 PRODUCTS

Not Applicable

PART 3 EXECUTION

3.01 SCOPE

A. Perform all necessary field survey work required to construct all elements of the project as shown on the Drawings and as specified herein.

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Surveying work shall be performed by a Professional Land Surveyor licensed and registered in the State of New York.

B. Contractor shall coordinate work and Surveyor's work to avoid delays.

C. Establish pre-construction topography of work area. Contractor may accept topography shown on Drawings as accurate, in lieu of developing new topography. Commencing work without performing pre-construction survey implies acceptance of topography on Drawings.

D. Prior to construction, all work shall be staked out to establish elevations and locations, and this information shall be plotted and available to the Engineer. The exact position of all work shall be established from control points and section grid lines established at the site.

E. The Contractor shall locate and place all cut, fill, slope, final grade, or other stakes and points, as the Engineer may direct for the proper progress of the work. All control points shall be properly guarded and flagged for easy identification.

F. The Contractor shall be responsible for the accuracy of the work and shall maintain all reference points, stakes, etc., throughout the life of the project. Damaged or destroyed points, benchmarks, stakes, or any reference points made inaccessible by the progress of the construction, shall be replaced or transferred by the Contractor. Any of the control points shall be referenced by ties to acceptable objects and recorded. Any alterations or revisions in the ties shall be so noted and the information furnished to the Engineer immediately. All computations necessary to establish the exact position of the work from control points shall be made and preserved by the contractor. All computations, survey notes, and other records necessary to accomplish the work shall be legible and preserved for the duration of construction.

G. The Contractor shall provide the Engineer with as-built grades of constructed work.

3.03 AS-BUILT SURVEY

A. Surveys shall be on a grid with a maximum spacing of 10 feet or an equivalent method approved by the Engineer, with additional elevations at slope change locations. The as- built survey shall include locations and elevations of all constructed work as directed by the Engineer.

END OF SECTION

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SECTION 024100
DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Selective demolition of building elements for alteration purposes.

1.02 REFERENCE STANDARDS

A. 29 CFR 1926 - Safety and Health Regulations for Construction Current Edition.

B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations 2019.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

1.04 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Notify Engineer of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
   1. If suspected hazardous materials are encountered, do not disturb; immediately notify Engineer and Owner. Hazardous materials will be removed by Owner under a separate contract.

E. Storage or sale of removed items or materials on-site is not permitted.

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

PART 2 PRODUCTS

2.01 MATERIALS

A. Not applicable.

PART 3 EXECUTION

3.01 SCOPE

A. Remove other items indicated, for salvage, relocation, recycling, and as indicated.

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
   1. Obtain required permits.
   2. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
   3. Provide, erect, and maintain temporary barriers and security devices.
   4. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
   5. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
   6. Do not close or obstruct roadways or sidewalks without permission.
   7. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.

8. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.

B. Do not begin removal until receipt of notification to proceed from Owner.

C. Do not begin removal until vegetation to be relocated has been removed and specified measures have been taken to protect vegetation to remain.

D. Protect existing structures and other elements that are not to be removed.
   1. Provide bracing and shoring.
   2. Prevent movement or settlement of adjacent structures.
   3. Stop work immediately if adjacent structures appear to be in danger.

E. Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

F. If hazardous materials are discovered during removal operations, stop work and notify Engineer and Owner; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.

3.03 EXISTING UTILITIES

A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.

B. Protect existing utilities to remain from damage.

C. Do not disrupt public utilities without permit from authority having jurisdiction.

D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.

E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.

F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.

G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

H. Prepare building demolition areas by disconnecting and capping utilities outside the demolition zone; identify and mark utilities to be subsequently reconnected, in same manner as other utilities to remain.

3.04 SELECTIVE DEMOLITION FOR ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
   1. Verify that construction and utility arrangements are as indicated.
   2. Report discrepancies to Enigneer before disturbing existing installation.
   3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.

B. Remove existing work as indicated and as required to accomplish new work.
   1. Remove items indicated on drawings.

C. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove existing systems and equipment as indicated.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.
   2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
   3. Verify that abandoned services serve only abandoned facilities before removal.
   4. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification.

D. Protect existing work to remain.

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

3.05 DEBRIS AND WASTE REMOVAL

A. Remove debris, junk, and trash from site.

B. Leave site in clean condition, ready for subsequent work.

C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

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SECTION 031033
CONCRETE PATCHING

PART 1 GENERAL

1.01 DESCRIPTION

A. Wherever the words "approved by", "equivalent" or similar phrases are used in this specification, they shall be understood to mean that the material, process or item referred to shall require the written approval of the patching system manufacturer.

B. This specification shall be read in conjunction with project specifications, sketches, photographs and/or drawings indicating the precise extent of work and the use and location of specific materials.

C. Contractor shall make a pre-bid field visit to verify all work shown or not shown on the drawings.

1.02 WORK INCLUDED

A. Provide all labor, equipment and materials necessary to complete the following concrete repair work:
   1. Preparation of all surfaces to receive patching compound.
   2. Mixing and transportation of patching compound.
   3. Repairs to delaminated and scaled areas of existing concrete.
   4. Priming of repair areas and placement of patching compound.
   5. Finishing and curing of patches.
   6. Repair of cracks.

1.03 QUALITY ASSURANCE

A. Restoration Specialist: Work must be performed by a firm having not less than 5 years successful experience in comparable concrete repair projects, and employing personnel skilled in the restoration process and operations indicated.
   1. Only skilled journeyman masons and/or cement finishers who are familiar and experienced with the materials and methods specified and are familiar with the design requirements shall be used for concrete restoration.
   2. One skilled journeyman mason or cement finisher, trained and certified by the concrete repair system manufacturer shall be present at all times during concrete restoration and shall personally direct the work.

B. Field Construction Mock-Ups: Prior to start of general concrete restoration, prepare the following sample panels and sample areas on building where directed by Engineer or Owner's Representative. Obtain Engineer or Owner's Representative approval of sample before proceeding with the work. Retain accepted panels/sample areas in undisturbed condition, suitably marked, during restoration as a standard for judging completed work.
   1. Cleaning: Demonstrate materials and methods to be used for cleaning for each type of concrete surface and condition on sample panels each approximately 25 sq. ft. in area. Test adjacent non-masonry materials for possible reaction with cleaning materials. Allow waiting period of duration indicated, but not less than 7 calendar days after completion of sample panels for negative reactions.
   2. Crack Repair: Prepare a sample area for each type of crack repair required for stone (i.e. hairline cracks and microscopic cracks 1/64"-1/16" in size; cracks and voids larger than 1/8"). Repair shall demonstrate methods and quality of workmanship expected for crack repair.
   3. Patching: Prepare on-building sample of each type of construction to be patched, rebuilt and/or replaced (e.g. one balcony surface, one deck area, one cornice unit, one window sill; one wall area). Patching shall demonstrate methods and quality of workmanship expected of repair work.
   4. The samples of each type of repair work shall be done in an area that will be exposed to the same weathering conditions as the building. Allow samples to cure at least three days before obtaining acceptance of color, texture and detailing match. Samples shall be viewed from an approved distance.

C. Source of Materials: Obtain materials for patching, coating, sealing and crack repair from a single source manufacturer to ensure match quality, color, texture and detailing.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's technical data for each product indicated including recommendations for their application and use. Include test reports and certifications substantiating that products comply with requirements.

B. Submit the following items in time to prevent delay of the work and to allow adequate time for review and re-submittals, if needed. Do not order materials or start work before receiving the written approval.
   1. Written certificates from the patching materials manufacturer should be submitted stating that all installers of the patching material have successfully completed a training workshop for installation of the patching material, or have met alternative workmanship qualifications acceptable to the manufacturer.
   2. Safety Data Sheets (SDS) for all specified materials.
   3. Written verification that all specified items will be used. Provide purchase orders, shipping tickets, receipts, etc. to prove that the specified materials were ordered and received.

1.05 DELIVERY, STORAGE AND HANDLING:

A. Deliver materials to site in manufacturer's original unopened containers and packaging, bearing labels as to type and names of products and manufacturers.

B. Deliver and store restoration material in manufacturer's original, unopened containers with the grade, batch and production data shown on the container or packaging.

C. Protect restoration materials during storage and construction from wetting by rain, snow or ground water, and from staining or intermixture with earth or other types of materials.

D. Protect materials from deterioration by moisture and temperature. Store in a dry location or in waterproof containers. Keep containers tightly closed and away from open flames. Protect liquid components from freezing. Comply with manufacturer's recommendations for minimum and maximum temperature requirements for storage.

E. Comply with the manufacturer's written specifications and recommendations for mixing, application, and curing of grouts and patching materials.

1.06 PROTECTION / SITE CONDITIONS

A. Protect persons, vehicles, building site and surrounding buildings from injury resulting from concrete restoration work.

B. Clean concrete surfaces only when air temperatures are above 40 degrees F (4 deg. C) and will remain so until concrete has dried out.

C. Do not perform any patching unless air temperatures are between 40 degrees Fahrenheit (10 deg. C) and 86 degrees Fahrenheit (30 deg. C) and will remain so for at least 48 hours after completion of work.

D. Do not perform any patching work if precipitation is expected. In case of unexpected precipitation, work shall cease and all uncured material shall be adequately protected with an impermeable polyethylene sheet.

E. If either the ambient or subsurface temperature is expected to fall between 35F (2C) and 40F (4C) during curing and ultimate drying of the patching compound, then the cold weather precautions outlined in item 7 of this section of the specification shall be followed.

F. If ambient or surface temperature is expected to rise above 86F (30C) during application and curing of the patching compound, then the hot weather precautions outlined in item 8 of this section of the specifications shall be followed.

G. Cold Weather Precautions:
   1. SYSTEM 44-FS grades shall be substituted for SYSTEM 44 Regular grades. Do not mix or place different grades together.
   2. Curing times shall be extended to compensate for lower temperature cure.
   3. Do not proceed if temperatures will drop below freezing before patching compound has reached final set. Any material disrupted by early freezing must be removed and replaced under appropriate controls or conditions.
   4. If auxiliary heating will be used to protect freshly placed materials from freezing, equipment must not directly vent exhaust gases onto the repair materials or into repair

enclosure air. This may cause carbonation and low strength. Use moderate temperatures and heated air or radiant heat.

H. Hot Weather Precautions:
   1. SYSTEM 44 Regular grades shall be substituted for FS grades. Do not mix or place different grades together.
   2. All materials shall be kept cool, stored out of direct sun.
   3. Pre-cooling of subsurface shall be carried out by continuous wetting at least one hour before placing patching compounds. This shall be done by covering or draping the entire repair area with burlap and by continuously keeping the burlap wet. The burlap shall be removed just prior to the patching of each area, as work proceeds.
   4. In hot, dry, windy weather, repair areas shall be covered or draped with burlap for a minimum of 3 hours after patch placement, to avoid rapid drying of the patches. Maximum wet cure time shall not exceed 24 hours.

I. Prevent masonry patching materials from staining the face of other surfaces to be left exposed. Immediately remove all patching materials that come in contact with such surfaces.

J. Cover partially completed work when work is not in progress.

K. Protect sills, ledges and projections from droppings.

1.07 SEQUENCING / SCHEDULING:

A. Perform concrete restoration work in the following sequence:
   1. Remove paint, stains and plant material from all surfaces.
   2. Remove existing unsound materials from areas indicated to be restored.
   3. Pressure wash building and repair surfaces as indicated.
   4. Patch and repair existing concrete structures as indicated.

PART 2 MATERIALS

2.01 ELEMENTS

A. (03.1033.01) Edison 44-Regular for horizontal surfaces

B. (03.1033.02) Edison System 44-V/O for vertical and overhead surfaces.

C. (03.1033.03) Edison Flexi-Seal 510.

D. (03.1033.04) Edison SYSTEM 49 CPBA primer

2.02 PRODUCTS

A. Manufacturer, Basis of Design: Edison Coatings, Inc.; www:edisoncoatings.com
   1. Ardex : www.ardexamericas.com
   2. Substitutions: See Section 01 6000 - Product Requirements.

B. Patching compound shall be a prepackaged, 1-component, acrylic polymer modified blend of Portland cement, specially graded aggregates and admixtures, designed for low shrinkage, low stress cure, and compatibility with existing host concrete. Prior to patching, sample cores of existing concrete shall be delivered by Contractor to manufacturer for testing and evaluation. Patching compound shall be customized by manufacturer, so that compressive strength does not exceed 4000 psi, or 500 psi above the existing concrete's compressive strength, whichever is lower, as measured by ASTM C-109.
   1. Patching compound shall develop a minimum 200 psi direct tensile adhesion with host substrate, when applied in accordance with these specifications.
   2. Tensile strength of patching compound shall be a minimum of 400 psi. Flexural modulus shall be 1.1 x 106 psi. Material must be vapor permeable, with a minimum permeance of 8 perms at 1/2" depth as measured by ASTM E-96.
   3. Water used for cleaning, mixing and finishing shall be clean, potable, free from oil, acid, injurious amounts of vegetable matter, alkalies or other salts.
   4. No colorants, accelerators, bonding agents or other additives shall be added to the patching compound without express written direction of the manufacturer.

C. 03.1033.01: Edison 44-Regular for horizontal surfaces.

D. 03.1033.02: Edison System 44-V/O for vertical and overhead surfaces.

E. 03.1033.03: Edison Flexi-Seal 510.

1. Crack sealant for small cracks shall be an 100% solids, 2-component elastomeric epoxy with 110% elongation and minimum 1200 psi tensile strength as measured by ASTM D412.

F. 03.1033.04: Edison SYSTEM 49 CPBA.
   1. Primer and reinforcing steel primer/corrosion inhibitor shall be an alkaline, silica fume modified, latex modified cementitious coating.

G. The products specified herein shall be assumed to meet the performance criteria specified. If a proposed equal is submitted, thorough lab testing shall be required to establish equivalent performance levels. An independent testing laboratory shall be utilized as determined by the Engineer, and shall be paid for by the submitting party.

PART 3 EXECUTION

3.01 SURFACE PREPARATION

A. Prior to patching, all surfaces must be prepared in accordance with this section of the specifications.

B. Remove all unsound concrete, using lightweight demolition hammers, not to exceed 18 pounds in weight. All removals to be performed in accordance with ICRI Guideline #03730, which shall be a part of these specifications, with regard to removal geometry, exposing, undercutting and cleaning of embedded reinforcement, and conditioning of edges and surfaces. Following demolition, test surfaces for alkalinity/carbonation with a 1% solution of phenolphthalein. Surfaces which do not indicate alkalinity (solution turns pink) shall require further demolition.

C. Pressure wash all indicated surfaces using 3000-4000 psi water, as required to remove all dust and dirt. Abrasive shall be used in combination with water when cleaning repair cavities, as required to eliminate micro-cracked surface materials resulting from demolition. No water with concrete dust shall be allowed to remain on any surface following washing, and must be immediately removed, prior to drying and re-hardening.

D. The result of this preparation shall render a surface clean, meaning having complete exposure of sound original material without any deposits of contaminants, foreign matter or loose material, which could affect the bond or long-term durability of the surface and the patching compound.

3.02 CRACK REPAIR

A. Patching compounds are not to be used to bridge working cracks or joints.

B. Crack repair for small cracks less than 1/16" (62 mils, 1.5 mm) shall be performed following pressure washing and drying by gravity filling with elastomeric crack sealant. Cracks wider than 1/16" shall be grooved out to a nominal 1/2" x 1/2" (3mm x 3mm), and filled with crack sealant.

C. Expansion joints are not included under this section of the specification.

3.03 PRIMING OF REINFORCING STEEL

A. Any steel reinforcement exposed in the course of removing unsound materials shall be cleaned and prepared in accordance with the above specifications. The result of this cleaning shall be a steel surface free from visible rust or scale.

B. Following cleaning and prior to patching, apply cementitious corrosion inhibitive primer and bonding agent to all steel surfaces in accordance with manufacturer's instructions. Care must be taken to create a continuous coating on the full surface, including the underside of the undercut reinforcement. Observe manufacturer's guidelines with regard to minimum and maximum timing "windows" for patching after application of primer.

3.04 CONCRETE PATCHING

A. Following preparation, as specified above, contractor shall maintain work area in a clean condition, including materials, equipment and workers' footwear, to avoid tracking in of contaminants, dirt, dust, mud or other materials which may interfere with adhesion and durability of repairs.

B. Prior to patching, all repair areas to be patched shall be kept continuously wet for at least 20 minutes prior to application of patching compound. Before placing patch, excess water

shall be blown, vacuumed or otherwise removed from the surface, leaving the surface damp or saturated/surface dry.

C. Vigorously brush-apply a slurry coat of cementitious primer / bonding agent with into all cavity surfaces.

D. Immediately after primer application, and while primer is still wet, mix and place patching compound in accordance with manufacturer's instructions.

E. Mix the measured quantity of water specified by the manufacturer with full bags of patching compound only. Mix using slow speed drill (450 rpm maximum) with mud or paddle mixer. Motorized mortar mixers may be used for mixing larger quantities. Mix for precisely 4 minutes, using a mix timer. Mix to a uniform consistency, free of lumps or dry material. Do not whip air into the mix. Do not over-mix.

F. When placing the patching compound, care shall be taken to assure that all corners and gaps under reinforcing steel and entire cavity profile is completely filled and properly compacted to prevent formation of voids or un-bonded areas. Work the material into corners and gaps, and onto cavity sidewalls using pressure on the trowel to assure good contact between patch and substrates.

G. Patches deeper than 1½" (25 mm) may be extended by coarse aggregate addition. 20 pounds of clean, washed, 3/8" pea stone suitable in composition and surface profile for use as a concrete aggregate, may be added to each 50 pound bag of patching compound.

H. Do not re-temper material which has begun to set. Discard any unused material after 30 minutes. Do not excessively wet patch surfaces after placement or as an aid to troweling. Limit surface water addition to light misting and do not wet or rework repeatedly.

I. Observe the curing requirements for each day's working conditions, as specified herein. Do not extend wet curing beyond the maximum specified. Do not open to traffic or expose to weather until adequate strength has been reached, as affected by working and curing conditions.

END OF SECTION

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SECTION 033000
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY:

A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
   1. Footings.
   2. Foundation walls.
   3. Slabs-on-grade.
   4. Suspended slabs.
   5. Building walls.

B. Related Sections include the following:
   1. Division 31 Section "Earth Moving" for drainage fill under slabs-on-grade.
   2. Division 32 Section "Concrete Paving" for concrete pavement and walks.

1.03 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.04 REFERENCE STANDARDS

A. ACI 117 - Specifications for Tolerances for Concrete Construction and Materials 2010 (Reapproved 2015).

B. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete 1991 (Reapproved 2009).

C. ACI 301 - Specifications for Structural Concrete 2016.

D. ACI 305R - Guide to Hot Weather Concreting 2010.

E. ACI 306R - Guide to Cold Weather Concreting 2016.

F. ACI 308R - Guide to External Curing of Concrete 2016.

G. ACI 318 - Building Code Requirements for Structural Concrete and Commentary 2014 (Errata 2018).

H. ASTM A184/A184M - Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement 2019.

I. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement 2020.

J. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field 2021a.

K. ASTM C33/C33M - Standard Specification for Concrete Aggregates 2018.

L. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens 2021.

M. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete 2021.

N. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens) 2020b.

O. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete 2020.

P. ASTM C150/C150M - Standard Specification for Portland Cement 2020.

Q. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete 2016.

R. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete 2010a (Reapproved 2016).

S. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete 2019.

T. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete 2019.

U. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete 2019.

V. ASTM C881/C881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete 2020a.

W. ASTM C1059/C1059M - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete 2021.

X. ASTM C1077 - Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation 2017.

Y. ASTM C1116/C1116M - Standard Specification for Fiber-Reinforced Concrete 2010a (Reapproved 2015).

Z. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures 2020.

AA. ASTM D448 - Standard Classification for Sizes of Aggregate for Road and Bridge Construction 2012 (Reapproved 2017).

BB. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types) 2018.

CC. ASTM D1752 - Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction 2018.

DD. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness 2015, with Editorial Revision (2017).

EE. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection 2020.

FF. ASTM E1155 - Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers 2020.

GG. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs 2017.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: For each type of product indicated.

C. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1. Indicate amounts of mixing water to be withheld for later addition at Project site.

D. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

E. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

1. Location of construction joints is subject to approval of the Architect.

F. Welding certificates.

G. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Form materials and form-release agents.
4. Steel reinforcement and accessories.
5. Fiber reinforcement.
6. Waterstops.
7. Curing compounds.
8. Floor and slab treatments.
9. Bonding agents.
10. Adhesives.
11. Vapor retarders.
12. Semirigid joint filler.
13. Joint-filler strips.
14. Repair materials.

H. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
   1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

I. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

J. Field quality-control reports.

K. Minutes of preinstallation conference.

1.06 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301 and ACI 318.

B. Follow recommendations of ACI 305R when concreting during hot weather.

C. Follow recommendations of ACI 306R when concreting during cold weather.

D. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

E. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.
   1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

F. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C1077 and ASTM E329 for testing indicated.
   1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
   2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

G. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

H. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
   1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5.
   2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

I. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

J. Preinstallation Conference: Conduct conference at Project site.
   1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
      a. Contractor's superintendent.
      b. Ready-mix concrete manufacturer.
      c. Concrete subcontractor.
   2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 PRODUCTS

2.01 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
   1. Plywood, metal, or other approved panel materials.
   2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
      a. High-density overlay, Class 1 or better.
      b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
      c. Structural 1, B-B or better; mill oiled and edge sealed.
      d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

D. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

E. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

F. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
   1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

G. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
   1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
   2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.

3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.02 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A615/A615M, Grade 60, deformed.

B. Steel Bar Mats: ASTM A184/A184M, fabricated from ASTM A615/A615M, Grade 60, deformed bars, assembled with clips.

C. Plain-Steel Wire: ASTM A 82, as drawn.

D. Deformed-Steel Wire: ASTM A 496.

E. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.

2.03 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars, cut bars true to length with ends square and free of burrs.

B. Epoxy-Coated Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars, ASTM A 775/A 775M epoxy coated.

C. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775/A 775M.

D. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
   1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.04 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
   1. Portland Cement: ASTM C150/C150M, Type I/II gray.

B. Normal-Weight Aggregates: ASTM C33/C33M, Class 3M coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
   1. Maximum Coarse-Aggregate Size: 1 inch nominal.
   2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: ASTM C94/C94M and potable.

2.05 ADMIXTURES

A. Air-Entraining Admixture: ASTM C260/C260M.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
   1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
   2. Retarding Admixture: ASTM C494/C494M, Type B.
   3. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.
   4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
   5. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G.
   6. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.

2.06 WATER STOPS

A. Flexible PVC Waterstops: CE CRD-C 572,[with factory-installed metal eyelets,] for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
   1. Available Manufacturers:
      a. Bometals, Inc.
      b. Greenstreak.
      c. Meadows, W. R., Inc.
      d. Murphy, Paul Plastics Co.
      e. Progress Unlimited, Inc.
      f. Tamms Industries, Inc.
      g. Vinylex Corp.
   2. Profile: Ribbed with center bulb.
   3. Dimensions: 6 inches by 3/8 inch thick (150 mm by 10 mm thick); nontapered.

B. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch (19 by 25 mm).
   1. Available Products:
      a. Colloid Environmental Technologies Company; Volclay Waterstop-RX.
      b. Concrete Sealants Inc.; Conseal CS-231.
      c. Greenstreak; Swellstop.
      d. Henry Company, Sealants Division; Hydro-Flex.
      e. JP Specialties, Inc.; Earthshield Type 20.
      f. Progress Unlimited, Inc.; Superstop.
      g. TCMiraDRI; Mirastop.

2.07 VAPOR RETARDERS

A. Sheet Vapor Retarder: ASTM E1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Carlisle Coatings & Waterproofing, Inc.; Blackline 400.
      b. Fortifiber Building Systems Group; Moistop Ultra 15.
      c. Grace Construction Products, W. R. Grace & Co.; Florprufe 120.
      d. Meadows, W. R., Inc.; Perminator 15 mil.
      e. Raven Industries Inc.; Vapor Block 15.
      f. Reef Industries, Inc.; Griffolyn Type-105 15 mil Green.
      g. Stego Industries, LLC; Stego Wrap 15 mil Class A
      h. Or Approved Equal

B. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D448, Size 57, with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

C. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D448, Size 10, with 100 percent passing a 3/8-inch sieve, 10 to 30 percent passing a No. 100 sieve, and at least 5 percent passing No. 200 sieve; complying with deleterious substance limits of ASTM C33/C33M for fine aggregates.

2.08 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

B. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 1, Class B, dissipating.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.
      b. BASF Construction Chemicals - Building Systems; Kure 200.
      c. ChemMasters; Safe-Cure Clear.
      d. Conspec by Dayton Superior; W.B. Resin Cure.
      e. Dayton Superior Corporation; Day-Chem Rez Cure (J-11-W).
      f. Edoco by Dayton Superior; Res X Cure WB.
      g. Euclid Chemical Company (The), an RPM company; Kurez W VOX; TAMMSCURE WB 30C.
      h. Kaufman Products, Inc.; Thinfilm 420.
      i. Lambert Corporation; AQUA KURE - CLEAR.
      j. L&M Construction Chemicals, Inc.; L&M Cure R.
      k. Meadows, W. R., Inc.; 1100-CLEAR.
      l. Nox-Crete Products Group; Resin Cure E.
      m. Right Pointe; Clear Water Resin.
      n. SpecChem, LLC; Spec Rez Clear.
      o. Symons by Dayton Superior; Resi-Chem Clear.
      p. TK Products, Division of Sierra Corporation; TK-2519 DC WB.
      q. Vexcon Chemicals, Inc.; Certi-Vex Enviocure 100.

2.09 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber or ASTM D1752, cork or self-expanding cork.

B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D2240.

C. Bonding Agent: ASTM C1059/C1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C881/C881M, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
   1. Types I and II, non-load bearing Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

E. Reglets: Fabricate reglets of not less than 0.022-inch-thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

F. Dovetail Anchor Slots: Hot-dip galvanized steel sheet, not less than 0.034 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.10 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
   1. Cement Binder: ASTM C150/C150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
   2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
   3. Aggregate: Well-graded, washed gravel, 1/8 to ¼ inch or coarse sand as recommended by underlayment manufacturer.
   4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C109/C109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.
   1. Cement Binder: ASTM C150/C150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
   2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
   3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
   4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C109/C109M.

2.11 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
   1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
   1. Fly Ash: 25 percent.
   2. Combined Fly Ash and Pozzolan: 25 percent.
   3. Ground Granulated Blast-Furnace Slag: 50 percent.
   4. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.

D. Admixtures: Use admixtures according to manufacturer's written instructions.
   1. Use water-reducing high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
   2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
   3. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

2.12 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings: Proportion normal-weight concrete mixture as follows:
   1. Minimum Compressive Strength: 4000 psi at 28 days.
   2. Maximum Water-Cementitious Materials Ratio: 0.45.
   3. Slump Limit: 4 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
   4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch nominal maximum aggregate size.

B. Foundation Walls: Proportion normal-weight concrete mixture as follows:
   1. Minimum Compressive Strength: 4000 psi at 28 days.
   2. Maximum Water-Cementitious Materials Ratio: 0.45.
   3. Slump Limit: 4 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
   4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch nominal maximum aggregate size.

C. Tipping Floor Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:
   1. Minimum Compressive Strength: 6000 psi at 28 days.
   2. Minimum Cementitious Materials Content: 520 lb/cu. yd.
   3. Slump Limit: 5 inches, plus or minus 1 inch.
   4. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

D. Process Area Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:
   1. Minimum Compressive Strength: 5000 psi at 28 days.
   2. Minimum Cementitious Materials Content: 520 lb/cu. yd.
   3. Slump Limit: 5 inches, plus or minus 1 inch.
   4. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

E. Suspended Slabs: Proportion normal-weight concrete mixture as follows:
   1. Minimum Compressive Strength: 4000 psi at 28 days.
   2. Minimum Cementitious Materials Content: 520 lb/cu. yd.
   3. Slump Limit: 4 inches plus or minus 1 inch.
   4. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

F. Building walls: Proportion normal-weight concrete mixture as follows:
   1. Minimum Compressive Strength: 5000 psi at 28 days.
   2. Minimum Cementitious Materials Content: 520 lb/cu. yd.
   3. Slump Limit: 4 inches plus or minus 1 inch.
   4. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

2.13 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.14 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C94/C94M and ASTM C1116/C1116M, and furnish batch ticket information.
   1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 EXECUTION

3.01 EXAMINATION

A. Grounding Installation:
   1. The Concrete Contractor shall make certain that the conductor for building steel grounding has been installed.

3.02 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
   1. Class A, 1/8 inch for smooth-formed finished surfaces.
   2. Class C, 1/2 inch for rough-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
   1. Install keyways, reglets, recesses, and the like, for easy removal.
   2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to

prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.03 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
   2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete at exterior walls, where flashing is shown at lintels, and other conditions.

3.04 REMOVING AND REUSING FORMS

A. General: Formwork for sides of walls, piers, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.05 VAPOR RETARDERS

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
   1. Lap joints 6 inches and seal with manufacturer's recommended tape.

3.06 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
   1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

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

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

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

E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.07 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
   1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
   1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
   2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 07 Section "Joint Sealants," are indicated.
   3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.08 WATERSTOPS

A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.

B. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

3.09 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
   1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
   1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
   2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
   3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to

consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
   1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
   2. Maintain reinforcement in position on chairs during concrete placement.
   3. Screed slab surfaces with a straightedge and strike off to correct elevations.
   4. Slope surfaces uniformly to drains where required.
   5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

F. Cold-Weather Placement: Comply with ACI 306R.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
   1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
   2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
   3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

G. Hot-Weather Placement: Comply with ACI 301 and as follows:
   1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
   2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.10 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
   1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
   1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, to be covered with a coating or covering material applied directly to concrete.

C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:
   1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
   2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.

3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix one part portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.11 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, re-straightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.

1. Apply scratch finish to surfaces indicated and to receive concrete floor toppings to receive mortar setting beds for bonded cementitious floor finishes

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Re-straighten, cut down high spots, and fill low spots. Repeat float passes and re-straightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces indicated to receive trowel finish.

D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and re-straighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface.
3. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/4 inch.

E. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.12 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

3.13 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306R.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, and other surfaces.

E. Cure concrete according to ACI 308R.1, by one or a combination of the following methods:
   1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
      a. Water.
      b. Continuous water-fog spray.
      c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
   2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
      a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
      b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
      c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.
   3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
      a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.
   4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.14 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
   1. Defer joint filling until concrete has aged at least six months. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.15 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place

patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.16 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Inspections:
   1. Steel reinforcement placement.
   2. Headed bolts and studs.
   3. Verification of use of required design mixture.
   4. Concrete placement, including conveying and depositing.
   5. Curing procedures and maintenance of curing temperature.

C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
   1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
   2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.
      a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
   3. Slump: ASTM C143/C143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
   4. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
   5. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
   6. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
   7. Compression Test Specimens: ASTM C31/C31M.
      a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
      b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.
   8. Compressive-Strength Tests: ASTM C39/C39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
      a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
      b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
   9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
   10. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength

and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

11. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
12. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
13. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by Architect.
14. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
15. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

D. Measure floor and slab flatness and levelness according to ASTM E1155 within 24 hours of finishing.

END OF SECTION

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SECTION 042200
CONCRETE UNIT MASONRY

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SECTION INCLUDES

A. Concrete masonry units.

B. Mortar and grout.

C. Steel reinforcing bars.

D. Masonry joint reinforcement.

E. Ties and anchors.

F. Embedded flashing.

G. Miscellaneous masonry accessories.

H. Masonry-cell insulation.

1.03 RELATED REQUIREMENTS

A. Section 072140 - Foamed-in-Place Masonry Wall Insulation

B. Division 07 Section "Sheet Metal Flashing and Trim" for exposed sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.

1.04 REFERENCE STANDARDS

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

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

C. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications 2020a.

D. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes 2017.

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

F. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts 2015.

G. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire 2019.

H. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.

I. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.

J. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement 2016, with Editorial Revision (2018).

K. 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 2021.

L. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete 2018a.

M. ASTM B370 - Standard Specification for Copper Sheet and Strip for Building Construction 2012 (Reapproved 2019).

N. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel 2019.

O. ASTM C55 - Standard Specification for Concrete Building Brick 2017.

P. ASTM C62 - Standard Specification for Building Brick (Solid Masonry Units Made From Clay or Shale) 2017.

Q. ASTM C67/C67M - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile 2021.

R. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units 2016a.

S. ASTM C91/C91M - Standard Specification for Masonry Cement 2018.

T. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units 2017.

U. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete 2020.

V. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar 2018.

W. ASTM C150/C150M - Standard Specification for Portland Cement 2020.

X. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes 2018.

Y. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made From Clay or Shale) 2021.

Z. ASTM C270 - Standard Specification for Mortar for Unit Masonry 2019.

AA. ASTM C404 - Standard Specification for Aggregates for Masonry Grout 2018.

BB. ASTM C476 - Standard Specification for Grout for Masonry 2020.

CC. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete 2019.

DD. ASTM C615/C615M - Standard Specification for Granite Dimension Stone 2018, with Editorial Revision.

EE. ASTM C744 - Standard Specification for Prefaced Concrete and Calcium Silicate Masonry Units 2016.

FF. ASTM C1634 - Standard Specification for Concrete Facing Brick 2017.

GG. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing 2017.

HH. ASTM D1056 - Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber 2020.

II. ASTM D2000 - Standard Classification System for Rubber Products in Automotive Applications 2018.

JJ. ASTM D4637/D4637M - Standard Specification for EPDM Sheet Used in Single-Ply Roof Membrane 2015.

KK. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials 2020.

LL. ASTM F1941/F1941M - Standard Specification for Electrodeposited Coatings on Mechanical Fasteners, Inch and Metric 2016.

MM. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures 2016.

1.05 DEFINITIONS

1.06 CMU(S): CONCRETE MASONRY UNIT(S).

A. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.07 SUBMITTALS

A. See Division 1, for submittal procedures.

B. Product Data: Provide data for each type of product indicated.

C. Shop Drawings: Indicate pertinent dimensions, materials, anchorage, size and type of fasteners, and accessories for brickwork support system.
   1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
   2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.

3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

D. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

E. Mortar: Submit color chart and samples showing range and variation

F. Material Certificates: For each type and size of the following:
   1. Masonry units.
      a. Retain second option in first subparagraph below if required by authorities having jurisdiction or if the added assurance of quality that test reports provide is desired.
      b. Include data on material properties material test reports substantiating compliance with requirements.
   2. Cementitious materials. Include brand, type, and name of manufacturer.
   3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
   4. Grout mixes. Include description of type and proportions of ingredients.
   5. Reinforcing bars.
   6. Joint reinforcement.
   7. Anchors, ties, and metal accessories.

G. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
   1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109 for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
   2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

H. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

I. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements

1.08 QUALITY ASSURANCE

A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.

B. Qualification data for testing agency: Qualified according to ASTM C1093 for testing indicated.

C. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

D. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

E. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.

F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination"

1.09 DELIVERY, STORAGE, AND HANDLING

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

B. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

C. Delete first two paragraphs below if requiring Contractor to use a preblended, dry mortar mix.

D. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

E. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

F. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.

G. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

PART 2 PRODUCTS

2.01 CONCRETE MASONRY ELEMENTS

A. Common CMU Elements
   1. (04.2200.01) 2" x 8" x 16" CMU common block
   2. (04.2200.02) 4" x 8" x 16" CMU common block
   3. (04.2200.03) 6" x 8" x 16" CMU common block
   4. (04.2200.04) 8" x 8" x 16" CMU common block
   5. (04.2200.05) 10" x 8" x 16" CMU common block
   6. (04.2200.06) 12" x 8" x 16" CMU common block

B. Mortars
   1. (04.2200.100) Historic Exterior Masonry Pointing Mortar: Type O; color to match existing.
   2. (04.2200.101) Masonry below grade and in contact with earth: Type S.
   3. (04.2200.102) Exterior Masonry Veneer: Type N.
   4. (04.2200.103) Exterior Cavity Walls: Type S mortar with Type N pointing mortar.
   5. (04.2200.104) Engineered Masonry: Type M.
   6. (04.2200.105) Exterior, Loadbearing Masonry: Type N.
   7. (04.2200.106) Exterior, Non-loadbearing Masonry: Type N.
   8. (04.2200.107) Exterior Repointing Mortar: Type N with maximum 2 percent ammonium stearate or calcium stearate per cement weight.
   9. (04.2200.108) Interior, Loadbearing Masonry: Type N.
   10. (04.2200.109) Interior, Non-loadbearing Masonry: Type N.
   11. (04.2200.110) Pointing Mortar for Prefaced or Specially Faced Unit Masonry: One part Portland cement, 1/8 part hydrated lime, and two parts graded (80 mesh) aggregate, proportioned by volume. Add aluminum tristearate, calcium stearate, or ammonium stearate equal to 2 percent of Portland cement by weight.
   12. (04.2200.111) Glass Unit Masonry: Type N mortar and Type O pointing mortar.
   13. (04.2200.112) Mortar For Firebrick Masonry: refractory type.
   14. (04.2200.113) Mortar for fire rated wall assemblies: Type M or S

2.02 MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.

B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.03 CONCRETE MASONRY UNITS

A. Concrete Block: Comply with referenced standards and as follows:
   1. Size: Standard units with nominal face dimensions of 16 by 8 inches (400 by 200 mm) and nominal depths as indicated on drawings for specific locations.
      a. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.

2. Load-Bearing Units: ASTM C90, normal weight.
   a. Hollow block, as indicated.
3. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
4. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
5. Provide square-edged units for outside corners unless otherwise indicated.
6. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2800 psi.
7. Exposed Faces: Provide color and texture matching the range represented by Engineer's sample.

2.04 CONCRETE BRICK:

A. Size: As indicated on drawings.

B. Concrete Building Brick: ASTM C55; lightweight, solid, for interior or concealed use.

2.05 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

B. Hydrated Lime: ASTM C207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of Portland cement and hydrated lime containing no other ingredients.

D. Masonry Cement: ASTM C91/C91M.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Capital Materials Corporation; Flamingo Color Masonry Cement.
      b. Cemex S.A.B. de C.V.; Brikset Type N Citadel Type S Dixie Type S Kosmortar Type N Richmortar Victor Plastic Cement.
      c. Essroc, Italcementi Group; Brixment or Velvet.
      d. Holcim (US) Inc.; Mortamix Masonry Cement Rainbow Mortamix Custom Buff Masonry Cement White Mortamix Masonry Cement.
      e. Lafarge North America Inc.; Magnolia Masonry Cement Lafarge Masonry Cement Trinity White Masonry Cement.
      f. Lehigh Cement Company; Lehigh Masonry Cement Lehigh White Masonry Cement.
      g. National Cement Company, Inc.; Coosa Masonry Cement.

E. Mortar Cement: ASTM C1329.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Lafarge North America Inc.; Lafarge Mortar Cement or Magnolia Superbond Mortar Cement.

F. Aggregate for Mortar: ASTM C144.
   1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
   2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
   3. White-Mortar Aggregates: Natural white sand or crushed white stone.

G. Aggregate for Grout: ASTM C404.

H. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494/C494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Euclid Chemical Company (The); Accelguard 80.
      b. Grace Construction Products, W. R. Grace & Co. - Conn.; Morset.

c. Sonneborn Products, BASF Aktiengesellschaft; Trimix-NCA.

I. Water: Clean and potable.

2.06 REINFORCEMENT AND ANCHORAGE

A. Uncoated Steel Reinforcing Bars: ASTM C615/C615M, Grade 60.

B. Masonry Joint Reinforcement, General: ASTM A951/A951M.
   1. Mill-galvanized coating is not as thick as hot-dip galvanized coating. According to ASTM A951/A951M, mill-galvanized coating may be applied to wire before fabricating, but hot-dip galvanized coating must be applied after fabricating.
   2. Interior Walls: Millgalvanized, carbon steel.
   3. Exterior Walls: Hot-dip galvanized, carbon steel.
   4. Retain one wire size in first two subparagraphs below.
   5. Wire Size for Side Rods: 0.187-inch diameter.
   6. Wire Size for Cross Rods: 0.187-inch diameter.
   7. Retain first subparagraph below and retain one wire size if adjustable (two-piece) type reinforcement is required.
   8. Wire Size for Veneer Ties0.187-inch diameter.
   9. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
   10. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

2.07 TIES AND ANCHORS

A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.
   1. Mill-Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A641/A641M, Class 1 coating.
   2. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A153/A153M Class B-2 coating.
   3. Galvanized Steel Sheet: ASTM A653/A653M, Commercial Steel, G60 zinc coating.
   4. Steel Sheet, Galvanized after Fabrication: ASTM A1008/A1008M, Commercial Steel, with ASTM A153/A153M, Class B coating.
   5. Stainless-Steel Sheet: ASTM A666, Type 304 or Type 316.
   6. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
   7. Stainless-Steel Bars: ASTM A276/A276M or ASTM A666, Type 304.
   8. Flexible Anchors: 2-piece anchors that permit differential movement between masonry and building frame, sized to provide not less than 5/8 inch (16 mm) of mortar coverage from masonry face.
   9. Metal-to-Metal Fasteners: Self-drilling, self-tapping screws; corrosion resistant finish or hot dip galvanized to ASTM A153/A153M.

2.08 MISCELLANEOUS ANCHORS

A. Unit Type Inserts in Concrete: Cast-iron or malleable-iron wedge-type inserts.

B. Anchor Bolts: Headed steel bolts complying with ASTM A307, Grade A with ASTM A563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A153/A153M, Class C; of dimensions indicated.

C. Usually delete paragraph below and include in Sections specifying items anchored.

D. Post installed Anchors: Torque-controlled expansion anchors or chemical anchors.

E. Load Capacity: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
   1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5 unless otherwise indicated.
   2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 A1 Group 2 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.09 EMBEDDED FLASHING MATERIAL

A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual; Division 07 Section "Sheet Metal Flashing and Trim" and as follows:
   1. Stainless Steel: ASTM A240/A240M, Type 304, 0.016 inch (0.40 mm) thick.
   2. Copper: ASTM B370, Temper H00, cold-rolled copper sheet, 16-oz./sq. ft. (4.9-kg/sq. m) weight or 0.0216 inch (0.55 mm) thick or ASTM B 370, Temper H01, high-yield copper sheet, 12-oz./sq. ft. (3.7-kg/sq. m) weight or 0.0162 inch (0.41 mm) thick.
   3. Fabricate continuous flashings in sections 96 inches (2400 mm) long minimum, but not exceeding 12 feet (3.7 m). Provide splice plates at joints of formed, smooth metal flashing.
   4. Fabricate through-wall metal flashing embedded in masonry from stainless steel or copper, with ribs at 3-inch (76-mm) intervals along length of flashing to provide an integral mortar bond.
      a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
         1) Cheney Flashing Company; Cheney Flashing (Dovetail) or Cheney 3-Way Flashing (Sawtooth).
         2) Keystone Flashing Company, Inc.; Keystone 3-Way Interlocking Thru wall Flashing.
         3) Sandell Manufacturing Co., Inc.; Mechanically Keyed Flashing.

B. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.10 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene urethane or PVC.

B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D2000, Designation M2AA-805 or PVC, complying with ASTM D 2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D226/D226M, Type I (No. 15 asphalt felt).

D. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Dayton Superior Corporation, Dur-O-Wal Division; D/A 810, D/A 812 or D/A 817.
      b. Heckmann Building Products Inc.; No. 376 Rebar Positioner.
      c. Hohmann & Barnard, Inc.; #RB or #RB-Twin Rebar Positioner.
      d. Wire-Bond; O-Ring or Double O-Ring Rebar Positioner.

2.11 MASONRY-CELL INSULATION

A. Specified in Section 07 21 40 "Foamed-in-Place Masonry Wall Insulation"

2.12 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
   1. Do not use calcium chloride in mortar or grout.
   2. Retain one or more of first three subparagraphs below to indicate acceptable mortar types.
   3. Use Portland cement-lime masonry cement or mortar cement mortar unless otherwise indicated.

4. For exterior masonry, use Portland cement-lime masonry cement or mortar cement mortar.
5. For reinforced masonry, use Portland cement-lime masonry cement or mortar cement mortar.
6. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.
1. For masonry below grade or in contact with earth, use Type M or Type S.
2. For reinforced masonry, use Type S or Type N.
3. For mortar parge coats, use Type S or Type N.
4. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.
5. For interior non-load-bearing partitions, Type O may be used instead of Type N.

D. Grout for Unit Masonry: Comply with ASTM C476.
1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi .
3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C143/C143M.

2.13 LINTELS

A. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.14 MORTAR AND GROUT MIXING

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry.

B. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.

C. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

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

3.02 COLD AND HOT WEATHER REQUIREMENTS

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

3.03 INSTALLATION, GENERAL

A. Build chases and recesses to accommodate items specified in this and other Sections.

B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

C. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean,

sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.04 TOLERANCES

A. Dimensions and Locations of Elements:
   1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch or minus 1/4 inch .
   2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch.
   3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:
   1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
   2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet , 1/4 inch in 20 feet , or 1/2 inch maximum.
   3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet , 3/8 inch in 20 feet, or 1/2 inch maximum.
   4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet , 1/4 inch in 20 feet, or 1/2 inch maximum.
   5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet , 3/8 inch in 20 feet, or 1/2 inch maximum.
   6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.

C. Joints:
   1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
   2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
   3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
   4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch.

3.05 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4-inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.

H. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.

J. Retain one or more of first three subparagraphs below or revise to suit Project. Coordinate with firestopping requirements. Retain first subparagraph if live-load deflection of structure above will produce stress in masonry. Indicate on Drawings or insert descriptive requirements in this Section for building walls around steel joists and similar construction if required. Indicate joint-filler thickness on Drawings as well as details of connection required if structure acts as lateral support for partitions.
   1. Install compressible filler in joint between top of partition and underside of structure above.
   2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch clearance between end of anchor rod and end of tube. Space anchors 48 inches o.c. unless otherwise indicated.
   3. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Division 07 Section "Fire-Resistive Joint Systems."

3.06 MORTAR BEDDING AND JOINTING

A. Lay hollow CMUs as follows:
   1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
   2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
   3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
   4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.

B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Set cast-stone trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.
   1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
   2. Allow cleaned surfaces to dry before setting.
   3. Wet joint surfaces thoroughly before applying mortar.
   4. If another joint profile is used, revise first paragraph below or show on Drawings.

D. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

E. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

3.07 CONTROL AND EXPANSION JOINTS

A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Show locations of joints on Drawings.

C. Form control joints in concrete masonry using one of the following methods:

D. Retain one or more of four subparagraphs below.

E. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.

F. Install preformed control-joint gaskets designed to fit standard sash block.

G. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.

H. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.

I. LINTELS

J. Provide masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.

K. Delete paragraph below if bearing is shown on Drawings.

L. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.08 FLASHING

A. General: Install embedded flashing in masonry at lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

B. Install flashing as follows unless otherwise indicated:

C. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.

D. At lintels, extend flashing a minimum of 6 inches (150 mm) into masonry at each end. At heads and sills, extend flashing 6 inches (150 mm) at ends and turn up not less than 2 inches (50 mm) to form end dams.

E. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches (38 mm) or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Division 07 Section "Joint Sealants" for application indicated.

F. Install metal [**drip edges**] [**and**] [**sealant stops**] with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Division 07 Section "Joint Sealants" for application indicated.

G. Retain one of three subparagraphs below if flexible flashing materials are used. See Evaluations.

H. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall and adhere flexible flashing to top of metal drip edge.

I. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall and adhere flexible flashing to top of metal flashing termination.

J. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.

K. Install single-wythe CMU flashing system in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and with weep spouts aligned with face of wall. Install CMU web covers so that they cover upturned edges of CMU cell pans at CMU webs and extend from face shell to face shell.

L. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

3.09 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
   1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
   2. Limit height of vertical grout pours to not more than 60 inches.

3.10 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to meet specified requirements shall be done at Contractor's expense.

B. Inspections: Level 1 special inspections according to the "International Building Code."
   1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
   2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
   3. Place grout only after inspectors have verified proportions of site-prepared grout.

C. Testing Prior to Construction: One set of tests.

D. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.
   1. Retain first paragraph below if unit-strength method is used unless authorities having jurisdiction allow units to be tested as source quality control. Delete paragraph if retaining prism-test method.

E. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.
   1. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.

F. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for mortar air content and compressive strength.

G. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.

H. Prism Test: For each type of construction provided, according to ASTM C 1314 at 7 days and at 28 days.

3.11 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
   1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
   2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Engineer's approval of sample cleaning before proceeding with cleaning of masonry.
   3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
   4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
   5. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.12 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

3.13 PLACING AND BONDING

A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

B. Cut masonry units with saw. Install with cut surfaces and where possible, cut edges concealed.

C. Mix units for exposed unit masonry from several pallets or cubes as they are placed to produce uniform blend of colors and textures.

D. Stopping and Resuming Work: Rack back units; do not tooth.

E. Fill cores in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

F. Build non-load-bearing interior partitions full height and install compressible filler in joint between top of partition and underside of structure above.

G. Tool exposed joints Concaved when thumbprint hard, unless otherwise indicated.
   1. Keep cavities clean of mortar droppings and other materials during construction. Strike joints facing cavities flush.

H. Masonry shall not be constructed in temperatures below 40 degrees F. Provide a heat source and protection as required to maintain temperature above 40 degrees F.

I. All Cells with reinforcing bars or bolts shall be grouted solid.

J. Vertical cells to be grouted solid shall have a minimum clear opening of 3”x2-1/5”.

K. Hollow units shall be laid with full mortar coverage on the horizontal and vertical face shells except that webs shall also be bedded where they are adjacent to cells to be reinforced and/or filled with grout. In the starting course, on footing and solid foundation walls, and in non-reinforced grouted piers, pilaster and columns, solid masonry units shall be laid, with full head and bed joints.

L. Consolidate grout pours exceeding 12" in height by mechanical vibration and re-consolidate by mechanical vibrations after initial water loss and settlement has occurred.

M. Points of bearing shall be on two (2) courses minimum of masonry grouted solid continuously.

N. M/E/P lines shall not be run in any horizontal masonry wall joints, vertically in any reinforced or grouted masonry cells, nor under and parallel to any load bearing CMU walls.

O. Provide temporary adequate bracing as required during construction of masonry walls to withstand lateral loads and the pressure of fluid grout.

3.14 WEEPS/CAVITY VENTS

A. Install weeps in veneer and cavity walls at 24 inches (600 mm) on center horizontally on top of through-wall flashing above shelf angles and lintels and at bottom of walls.

3.15 REINFORCEMENT AND ANCHORAGE - GENERAL, SINGLE WYTHE MASONRY, AND CAVITY WALL MASONRY

A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches (400 mm) on center.

B. Fasten anchors to structural framing and embed in masonry joints as masonry is laid. Unless otherwise indicated on drawings or closer spacing is indicated under specific wall type, space anchors at maximum of 36 inches (900 mm) horizontally and 24 inches (600 mm) vertically.

3.16 MASONRY FLASHINGS

A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.

B. Extend plastic, laminated, and EPDM flashings to within 1/4 inch (6 mm) of exterior face of masonry.

C. Lap end joints of flashings at least 6 inches (152 mm), minimum, and seal watertight with flashing sealant/adhesive.

D. A. Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to the downward flow of water in the wall, and where indicated. In decorative CMU, use steel lintels as indicated on lintel schedule on drawings

1. Trim nicking material used in weep holes flush with outside face of wall after mortar has set.

3.17 LINTELS

A. Install loose steel lintels over openings.

B. Maintain minimum [8"] inch ([____] mm)bearing on each side of opening.

3.18 CONTROL AND EXPANSION JOINTS

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

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

C. Form expansion joint as detailed on drawings.

3.19 BUILT-IN WORK

A. As work progresses, install built-in metal door frames and glazed frames and other items to be built into the work and furnished under other sections.

B. Install built-in items plumb, level, and true to line.

C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout.

1. Fill adjacent masonry cores with grout minimum 12 inches (300 mm) from framed openings.

D. Do not build into masonry construction organic materials that are subject to deterioration.

3.20 TOLERANCES

A. Maximum Variation from Alignment of Columns: 1/4 inch (6 mm).

B. Maximum Variation from Unit to Adjacent Unit: 1/16 inch (1.6 mm).

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

3.21 FIELD QUALITY CONTROL

A. A. Owner may engage a qualified independent testing agency to perform the following tests for each 5000 sq. It. of wall area or portion thereof:

1. Mortar: ASTM C 780
2. Grout: ASTM C 1019
3. Brick: ASTM C 67
4. Concrete Masonry Units: ASTM C 140

B. An independent testing agency will perform field quality control tests, as specified in Section 014000 - Quality Requirements.

3.22 PARGING

A. Parge pre-dampened masonry walls, where indicated, with Type S or Type N mortar applied in two uniform coats with a steel-trowel finish. Form a wash at top of parging and a cove at bottom. Damp cure parging for at least 24 hours.

3.23 CLEANING

A. Remove excess mortar and mortar droppings.

B. Replace defective mortar. Match adjacent work.

C. Clean soiled surfaces with cleaning solution.

END OF SECTION

SECTION 051200
STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SECTION INCLUDES

A. Structural steel framing members.

B. Grouting under base plates.

1.03 RELATED REQUIREMENTS

A. Division 01 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.

B. Division 05 Section "Metal Fabrications" for steel lintels and shelf angles not attached to structural-steel frame, miscellaneous steel fabrications and other metal items not defined as structural steel.

C. Division 09 painting Sections and Division 09 Section "High-Performance Coatings" for surface-preparation and priming requirements.

1.04 PERFORMANCE REQUIREMENTS

A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand loads indicated and comply with other information and restrictions indicated.

1. Select and complete connections using schematic details indicated and AISC 360.

1.05 REFERENCE STANDARDS

A. AISC (MAN) - Steel Construction Manual 2017.

B. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges 2016.

C. AISC 360 - Specification for Structural Steel Buildings 2016 (Revised 2021).

D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2014.

E. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2020.

F. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.

G. ASTM A436 - Standard Specification for Austenitic Gray Iron Castings 1984 (Reapproved 2020).

H. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes 2021.

I. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts 2015.

J. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings 2009 (Reapproved 2015).

K. ASTM A992/A992M - Standard Specification for Structural Steel Shapes 2020.

L. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink) 2017.

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

N. ASTM E164 - Standard Practice for Contact Ultrasonic Testing of Weldments 2019.

O. ASTM E165/E165M - Standard Test Method for Liquid Penetrant Examination for General Industry 2018.

P. ASTM E709 - Standard Guide for Magnetic Particle Testing 2015.

Q. ASTM F436/F436M - Standard Specification for Hardened Steel Washers Inch and Metric Dimensions 2019.

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

S. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength 2020.

1.06 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: For each type of product indicated.

C. Shop Drawings: Show fabrication of structural-steel components.
   1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
   2. Include embedment drawings.
   3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
   4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.

D. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1, "Structural Welding Code - Steel," for each welded joint whether prequalified or qualified by testing, including the following:
   1. Power source (constant current or constant voltage).
   2. Electrode manufacturer and trade name, for demand critical welds.

E. Qualification Data: For qualified Installer, fabricator, and testing agency.

F. Welding certificates.

G. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

H. Mill test reports for structural steel, including chemical and physical properties.

I. Product Test Reports: For the following:
   1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
   2. Direct-tension indicators.
   3. Tension-control, high-strength bolt-nut-washer assemblies.
   4. Shop primers.
   5. Nonshrink grout.

J. Source quality-control reports.

1.07 QUALITY ASSURANCE

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

B. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category SBD.

C. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement P1, P2, P3 or SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel."

E. Comply with applicable provisions of the following specifications and documents:
   1. AISC 303.
   2. AISC 341 and AISC 341s1.
   3. AISC 360.
   4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

F. Preinstallation Conference: Conduct conference at Project site.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
   1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
   1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
   2. Clean and relubricate bolts and nuts that become dry or rusty before use.
   3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

1.09 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 PRODUCTS

2.01 STRUCTURAL STEEL MATERIALS

A. W-Shapes: ASTM A992/A992M.

B. Channels, Angles: ASTM A36/A36M.

C. Plate and Bar: ASTM A36/A36M.

D. Cold-Formed Hollow Structural Sections: ASTM A500/A500M, Grade B, structural tubing.

E. Steel Pipe: ASTM A53/A53M, Type E or S, Grade B.
   1. Weight Class: Standard.
   2. Finish: Black except where indicated to be galvanized.

F. Welding Electrodes: Comply with AWS requirements.

2.02 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade C, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.
   1. Direct-Tension Indicators: ASTM F959/F959M, Type 325, compressible-washer type with plain finish.

B. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy-hex head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.
   1. Finish: Plain.

C. Unheaded Anchor Rods: ASTM F1554, Grade 36.
   1. Configuration: Straight.

2. Nuts: ASTM A563 heavy-hex carbon steel.
3. Plate Washers: ASTM A36/A36M carbon steel.
4. Washers: ASTM A436 ASTM F 436, Type 1, hardened carbon steel.
5. Finish: Plain

D. Headed Anchor Rods: ASTM F1554, Grade 36, straight.
1. Nuts: ASTM A563 heavy-hex carbon steel.
2. Plate Washers: ASTM A 36 carbon steel.
3. Washers: ASTM F436/F436M, Type 1, hardened carbon steel.
4. Finish: Plain
5. Threaded Rods: ASTM A 36.
6. Nuts: ASTM A563 heavy hex carbon steel.
7. Washers: ASTM F436/F436M, Type 1, hardened ASTM A 36 carbon steel.
8. Finish: Plain

2.03 PRIMER

A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

B. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20 ASTM A780/A780M.

2.04 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and non-staining, mixed with water to consistency suitable for application and a 30-minute working time.

2.05 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.
1. Identify high-strength structural steel according to ASTM A 6 and maintain markings until structural steel has been erected.
2. Mark and match-mark materials for field assembly.
3. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.

C. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 2, "Hand Tool Cleaning or SSPC-SP 3, "Power Tool Cleaning."

F. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.
1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.06 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
1. Joint Type: Snug tightened

B. Weld Connections: Comply with AWS D1.1 and AWS D1.8 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

C. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

2.07 SHOP PRIMING

A. Shop prime steel surfaces except the following:
   1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
   2. Surfaces to be field welded.
   3. Surfaces to be high-strength bolted with slip-critical connections.
   4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
   5. Galvanized surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
   1. SSPC-SP 2, "Hand Tool Cleaning."
   2. SSPC-SP 3, "Power Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
   1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
   2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

2.08 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A123/A123M.
   1. Fill vent and drain holes that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.
   2. Galvanize lintels attached to structural-steel frame and located in exterior walls.

2.09 SOURCE QUALITY CONTROL

A. Testing Agency: Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.
   1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

C. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1 and the following inspection procedures, at testing agency's option:
   1. Liquid Penetrant Inspection: ASTM E165/E165M.
   2. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
   3. Ultrasonic Inspection: ASTM E1644.
   4. Radiographic Inspection: ASTM E94/E94M.

PART 3 EXECUTION

3.01 EXAMINATION

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

B. Verify, with steel Erector present, elevations of concrete and masonry bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
   1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

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

3.02 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

3.03 ERECTION

A. Erect structural steel in compliance with AISC 303.

B. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

C. Base and bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen surfaces prior to setting plates. Clean bottom surface of plates.
   1. Set plates for structural members on wedges, shims, or setting nuts as required.
   2. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
   3. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

D. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

E. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
   1. Level and plumb individual members of structure.
   2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

F. Splice members only where indicated.

G. Do not use thermal cutting during erection unless approved by Engineer. Finish thermally cut sections within smoothness limits in AWS D1.1.

H. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.04 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
   1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1 and AWS D1.8 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

3.05 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.

B. Bolted Connections: Bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Welded Connections: Field welds will be visually inspected according to AWS D1.1.
   1. In addition to visual inspection, field welds will be tested and inspected according to AWS D1.1 and the following inspection procedures, at testing agency's option:
      a. Liquid Penetrant Inspection: ASTM E 165.
      b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
      c. Ultrasonic Inspection: ASTM E 164.
      d. Radiographic Inspection: ASTM E 94.

D. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.06 REPAIRS AND PROTECTION

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.

B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
   1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

END OF SECTION

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SECTION 052100
STEEL JOIST FRAMING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SECTION INCLUDES

A. Open web steel joists, with bridging, attached seats and anchors.
   1. K-series steel joists.
   2. K-series steel joist substitutes.

1.03 DEFINITIONS

A. SJI "Specifications": Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."

1.04 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2014.

B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.

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

D. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts 2015.

E. ASTM F436/F436M - Standard Specification for Hardened Steel Washers Inch and Metric Dimensions 2019.

F. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: For each type of joist, accessory, and product indicated.

C. Shop Drawings: Indicate standard designations, joist coding, configurations, sizes, spacings, cambers, locations of joists, joist leg extensions, bridging, connections, attachments, and layout.
   1. Indicate locations and details of bearing plates to be embedded in other construction.

D. Welding certificates.

E. Manufacturer Certificates: Signed by manufacturers certifying that joists comply with requirements.

F. Mill Certificates: Signed by bolt manufacturers certifying that bolts comply with requirements.

G. Qualification Data: For manufacturer.

H. Field quality-control test and inspection reports.

I. Research/Evaluation Reports: For joists.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables of SJI "Specifications."

B. SJI Specifications: Comply with standard specifications in SJI's "Specifications" that are applicable to types of joists indicated.

C. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel."

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle joists as recommended in SJI's "Specifications."

B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

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

PART 2 PRODUCTS

2.01 MATERIALS

A. Steel: Comply with SJI's "Specifications" for web and steel-angle chord members.

B. Steel Bearing Plates: ASTM A36/A36M.

C. Carbon-Steel Bolts and Threaded Fasteners: ASTM A307, Grade A, carbon-steel, hex-head bolts and threaded fasteners; carbon-steel nuts; and flat, unhardened steel washers.
   1. Finish: Plain, uncoated

D. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts; ASTM A563 heavy hex carbon-steel nuts; and ASTM F436/F436M hardened carbon-steel washers.
   1. Finish: Plain.

E. Welding Electrodes: Comply with AWS standards.

2.02 PRIMERS

1. Primer: SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15.

2.03 K-SERIES STEEL JOISTS

A. Manufacture steel joists of type indicated according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members, underslung ends, and parallel top chord.
   1. Joist Type: K-series steel joists and KCS-type K-series steel joists.

B. B. Steel Joist Substitutes: Manufacture according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle or -channel members.

C. Comply with AWS requirements and procedures for shop welding, appearance, quality of welds, and methods used in correcting welding work.

D. Provide holes in chord members for connecting and securing other construction to joists.

E. Top-Chord Extensions: Extend top chords of joists with SJI's Type S top-chord extensions where indicated, complying with SJI's "Specifications."

F. Extended Ends: Extend bearing ends of joists with SJI's Type R extended ends where indicated, complying with SJI's "Specifications."

G. Camber joists according to SJI's "Specifications."

2.04 JOIST ACCESSORIES

A. Bridging: Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required for stability.

B. Bridging: Schematically indicated. Detail and fabricate according to SJI's "Specifications." Furnish additional erection bridging if required for stability.

C. Fabricate steel bearing plates with integral anchorages of sizes and thicknesses indicated. Hot-dip zinc coat according to ASTM A123/A123M.

D. Steel bearing plates with integral anchorages are specified in Division 05 Section "Metal Fabrications."

E. Supply miscellaneous accessories, including splice plates and bolts required by joist manufacturer to complete joist installation.

2.05 CLEANING AND SHOP PAINTING

A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by hand-tool cleaning, SSPC-SP 2 or power-tool cleaning, SSPC-SP 3.

B. Do not prime paint joists and accessories to receive sprayed fire-resistive materials.

C. Apply 1 coat of shop primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 1 mil thick.

D. Shop priming of joists and joist accessories is specified in Division 09 painting Sections.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions prior to beginning work.

B. Examine supporting substrates, embedded bearing plates, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.

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

3.02 INSTALLATION

A. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications," joist manufacturer's written recommendations, and requirements in this Section.
   1. Before installation, splice joists delivered to Project site in more than one piece.
   2. Space, adjust, and align joists accurately in location before permanently fastening.
   3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.

B. Field weld joists to supporting steel bearing plates. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

C. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

3.03 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and bolted connections and to perform field tests and inspections and prepare test and inspection reports.

B. Field welds will be visually inspected according to AWS D1.1.

C. Bolted connections will be visually inspected.

D. High-strength, field-bolted connections will be tested and verified according to procedures in RCSC's "Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts."

E. Correct deficiencies in Work that test and inspection reports have indicated are not in compliance with specified requirements.

F. Additional testing will be performed to determine compliance of corrected Work with specified requirements.

END OF SECTION

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SECTION 053100
STEEL DECKING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:
   1. Non-composite form deck.

B. Related Sections include the following:
   1. Division 05 Section "Structural Steel Framing" for shop- and field-welded shear connectors.

1.03 SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction. Identify deck areas to be protected with fireproofing and/or acoustical insulation.

C. Product Certificates: For each type of steel deck, signed by product manufacturer.
   1. Power-actuated mechanical fasteners.

D. Research/Evaluation Reports: For steel deck.

E. Welding certificates.

1.04 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency qualified according to ASTM E 329 for testing indicated.

B. Welding: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

C. Fire-Test-Response Characteristics: Where indicated, provide steel deck units identical to those tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
   1. Fire-Resistance Ratings: Indicated by design designations of applicable testing and inspecting agency.
   2. Steel deck units shall be identified with appropriate markings of applicable testing and inspecting agency.

D. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 PRODUCTS

2.01 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:
   1. Steel Deck:
      a. Canam Steel Corp.; The Canam Manac Group.

b. Epic Metals Corporation.
c. New Millennium Building Systems, LLC.
d. Nucor Corp.; Vulcraft Division.
e. United Steel Deck, Inc.
f. Or Approved Equal.

2.02 NON-COMPOSITE FLOOR DECK

A. Composite Steel Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 30, with the minimum section properties indicated, and with the following:
   1. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33, G60 zinc coating.
   2. Profile Depth: As indicated.
   3. Design Uncoated-Steel Thickness: As Indicated.
   4. Span Condition: Double span or more.

2.03 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi , not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Galvanizing Repair Paint: ASTM A 780.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

3.02 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 30, manufacturer's written instructions, and requirements in this Section.

B. Locate deck bundles to prevent overloading of supporting members.

C. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

D. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

E. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

F. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

G. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

H. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

I. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches.

J. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations, unless otherwise indicated.

K. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

3.03 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field welds will be subject to inspection.

C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.

D. Remove and replace work that does not comply with specified requirements.

E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.04 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 053100

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SECTION 054000
COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:
   1. Exterior non-load-bearing wall framing.

B. Related Sections include the following:
   1. Division 05 Section "Metal Fabrications" for masonry shelf angles and connections.
   2. Division 09 Section "Non-Structural Metal Framing" for interior non-load-bearing, metal-stud framing and ceiling-suspension assemblies.

1.03 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.
   1. Design Loads: As indicated.
   2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
      a. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/240 of wall height for walls not supporting masonry veneer & 1/600 of wall height for walls supporting brick veneer.
   3. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F (67 deg C).
   4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
      a. Upward and downward movement of L/240 for roof members.

B. Cold-Formed Steel Framing, General: Design according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions."
   1. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

1.04 SUBMITTALS

A. Product Data: For each type of cold-formed metal framing product and accessory indicated.

B. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
   1. For cold-formed metal framing indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Product Test Reports: From a qualified testing agency, unless otherwise stated, indicating that each of the following complies with requirements, based on evaluation of comprehensive tests for current products:
   1. Steel sheet.
   2. Expansion anchors.
   3. Power-actuated anchors.

4. Mechanical fasteners.
5. Vertical deflection clips.
6. Horizontal drift deflection clips
7. Miscellaneous structural clips and accessories.

D. Research/Evaluation Reports: For cold-formed metal framing.

1.05 QUALITY ASSURANCE

A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.

C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 to conduct the testing indicated.

D. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, ductility, and metallic-coating thickness.

E. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

F. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."
   1. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cold-formed metal framing that may be incorporated into the Work include, but are not limited to, the following:
   1. Allied Studco.
   2. AllSteel Products, Inc.
   3. California Expanded Metal Products Company.
   4. Clark Steel Framing.
   5. Consolidated Fabricators Corp.; Building Products Division.
   6. Craco Metals Manufacturing, LLC.
   7. Custom Stud, Inc.
   8. Dale/Incor.
   9. Design Shapes in Steel.
   10. Dietrich Metal Framing; a Worthington Industries Company.
   11. Formetal Co. Inc. (The).
   12. Innovative Steel Systems.
   13. MarinoWare; a division of Ware Industries.
   14. Quail Run Building Materials, Inc.
   15. SCAFCO Corporation.

16. Southeastern Stud & Components, Inc.
17. Steel Construction Systems.
18. Steeler, Inc.
19. Super Stud Building Products, Inc.
20. United Metal Products, Inc.

2.02 MATERIALS

A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
   1. Grade: As required by structural performance.
   2. Coating: G60 (Z180).

2.03 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: 0.0428 inch
   2. Flange Width: 1-5/8 inches .

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: 0.0428 inch
   2. Flange Width: 1-1/4 inches.

C. Vertical Deflection Clips: Manufacturer's standard bypass clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Dietrich Metal Framing; a Worthington Industries Company.
      b. MarinoWare, a division of Ware Industries.
      c. SCAFCO Corporation
      d. The Steel Network, Inc.

2.04 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
   1. Supplementary framing.
   2. Bracing, bridging, and solid blocking.
   3. Web stiffeners.
   4. End clips.
   5. Foundation clips.
   6. Gusset plates.
   7. Stud kickers, knee braces, and girts.
   8. Hole reinforcing plates.
   9. Backer plates.

C. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.

D. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.

E. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

F. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.

G. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.
   1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

2.05 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035.

2.06 FABRICATION

A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
   1. Fabricate framing assemblies using jigs or templates.
   2. Cut framing members by sawing or shearing; do not torch cut.
   3. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
      a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
      b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.
   4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:
   1. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
   2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch (3 mm).

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Install load bearing shims or grout between the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations to ensure a uniform bearing surface on supporting concrete or masonry construction.

B. Install sealer gaskets to isolate the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations.

3.03 INSTALLATION, GENERAL

A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.

C. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.
   1. Cut framing members by sawing or shearing; do not torch cut.
   2. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
      a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
      b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.

D. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

E. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

F. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.

G. Install insulation, specified in Division 07 Section "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

H. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.

I. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:
   1. Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.04 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.

B. Fasten both flanges of studs to top and bottom track, unless otherwise indicated. Space studs as follows:
   1. Stud Spacing: 16 inches

C. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
   1. Connect vertical deflection clips to bypassing studs and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced in rows indicated on Shop Drawings but not more than 48 inches (1220 mm) apart. Fasten at each stud intersection.
   1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of flat, taut, steel sheet straps of width and

thickness indicated and stud or stud-track solid blocking of width and thickness matching studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.

a. Install solid blocking at centers indicated on Shop Drawings.

2. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.

F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable wall-framing system.

3.05 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Remove and replace work where test results indicate that it does not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.06 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000

SECTION 055000
METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shop fabricated steel and aluminum items.

1.02 RELATED REQUIREMENTS

A. Division 1 - General provisions of the contract

B. Section 033000 - Cast-in-Place Concrete: Placement of metal fabrications in concrete.

C. Section 042200 - Concrete Unit Masonry: Placement of metal fabrications in masonry.

D. Section 051200 - Structural Steel Framing: Structural steel column anchor bolts.

1.03 REFERENCE STANDARDS

A. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes 2017.

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

C. ASTM A48/A48M - Standard Specification for Gray Iron Castings 2003 (Reapproved 2016).

D. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2020.

E. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates 2018.

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

G. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing 2014.

H. ASTM A554 - Standard Specification for Welded Stainless Steel Mechanical Tubing 2021.

I. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.

J. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength 2018a.

K. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.

L. ASTM B210/B210M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes 2019a.

M. ASTM B211/B211M - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire 2019.

N. ASTM B26/B26M - Standard Specification for Aluminum-Alloy Sand Castings 2018, with Editorial Revision.

O. ASTM B85/B85M - Standard Specification for Aluminum-Alloy Die Castings 2018, with Editorial Revision.

P. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.

Q. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.

R. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2020.

S. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength 2019, with Editorial Revision (2020).

T. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination 2012.

U. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification 2014 (Amended 2015).

V. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020.

W. AWS D1.2/D1.2M - Structural Welding Code - Aluminum 2014, with Errata.

X. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer 1999 (Ed. 2004).

Y. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic") 2002 (Ed. 2004).

1.04 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

1. Provide shop drawings for the following:
   a. Steel framing and supports for countertops.
   b. Steel framing and supports for mechanical and electrical equipment.
   c. Steel framing and supports for applications where framing and supports are not specified in other Sections.
   d. Metal bollards.
   e. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

C. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

1.06 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 PRODUCTS

2.01 METAL FABRICATED ELEMENTS

A. (05.5000.03) 8" O.D. bollard, painted safety yellow, filled with concrete with a 3/4" crown.

1. Bollard encased in minimum 24" diameter concrete, 42" deep below finished grade or finished floor. with a 6" (3/4") crushed stone base.

B. (05.5000.11) Lintels: As detailed; prime paint finish.

2.02 MATERIALS - STEEL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes

B. Steel Sections: ASTM A36/A36M.

C. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.

D. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.

E. Plates: ASTM A283/A283M.

F. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.

G. Stainless Steel, General: ASTM A666, Type 304.

H. Stainless Steel Tubing: ASTM A554, Type 304, 16 gauge, 0.0625 inch (1.59 mm) minimum metal thickness, 1-1/2 inch (38 mm) diameter.

I. Stainless Steel Bars, Shapes and Moldings: ASTM A276/A276M, Type 304.

J. Slotted Channel Framing: ASTM A653/A653M, Grade 33; Cold-formed metal box channels (struts) complying with MFMA-4.
   1. Size of Channels: As indicated .
   2. Material: Cold-rolled steel, ASTM A 1008/A 1008M, structural steel, Grade 33 (Grade 230); 0.0966-inch (2.5-mm) minimum thickness; unfinished

K. Slotted Channel Fittings: ASTM A1011/A1011M.

L. Mechanical Fasteners: Same material as or compatible with materials being fastened; type consistent with design and specified quality level.

M. Bolts, Nuts, and Washers: ASTM A307, Grade A, plain.

N. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, plain.

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

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

Q. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

R. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

S. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

T. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

U. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

V. Bronze Extrusions: ASTM B 455, Alloy UNS No. C38500 (extruded architectural bronze).

W. Bronze Castings: ASTM B 584, Alloy UNS No. C83600 (leaded red brass) or No. C84400 (leaded semi-red brass).

X. Nickel Silver Extrusions: ASTM B 151/B 151M, Alloy UNS No. C74500.

Y. Nickel Silver Castings: ASTM B 584, Alloy UNS No. C97600 (20 percent leaded nickel bronze).

2.03 MATERIALS - ALUMINUM

A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.

B. Plate and Sheet Aluminum: ASTM B209 (ASTM B209M), 5052 alloy, H32 or H22 temper.

C. Aluminum-Alloy Drawn Seamless Tubes: ASTM B210/B210M, 6063 alloy, T6 temper.

D. Aluminum-Alloy Bars: ASTM B211/B211M, 6061 alloy, T6 temper.

E. Aluminum-Alloy Sand Castings: ASTM B26/B26M.

F. Aluminum-Alloy Die Castings: ASTM B85/B85M, alloy 443.0.F.

G. Bolts, Nuts, and Washers: Stainless steel.

H. Welding Materials: AWS D1.2/D1.2M; type required for materials being welded.

2.04 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

D. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.05 FABRICATED ITEMS

A. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of metal decking; prime paint finish.

B. (05.5000.11) Lintels: As detailed; prime paint finish.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Obtain approval prior to site cutting or making adjustments not scheduled.

END OF SECTION

SECTION 055100
METAL STAIRS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Stairs with concrete treads.

B. Stairs with metal treads.

C. Stairs with grating treads.

D. Structural steel stair framing and supports.

E. Handrails and guards.

1.02 RELATED REQUIREMENTS

A. Section 099113 - Exterior Painting: Paint finish.

1.03 REFERENCE STANDARDS

A. ASTM A6/A6M - Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling 2019.

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

C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2020.

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

E. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates 2018.

F. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes 2021.

G. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing 2014.

H. 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 2021.

I. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength 2018a.

J. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength 2019, with Editorial Revision (2020).

K. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination 2012.

L. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020.

M. NAAMM AMP 510 - Metal Stairs Manual 1992.

N. NAAMM MBG 531 - Metal Bar Grating Manual 2017.

O. NAAMM MBG 532 - Heavy Duty Metal Bar Grating Manual 2009.

P. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer 1999 (Ed. 2004).

Q. SSPC-SP 2 - Hand Tool Cleaning 2018.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.

1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

C. Design Data: As required by authorities having jurisdiction.

1.05 QUALITY ASSURANCE

A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located, or personnel under direct supervision of such an engineer.

PART 2 PRODUCTS

2.01 METAL STAIRS AND RAILINGS

A. (05.5100.01) Metal pan stairs with concrete infill.

B. (05.5100.30) Fabricated single pipe rail, attached to wall

C. (05.5100.33) Fabricated pipe rail with vertical pickets
   1. Attached to stair stringers, 4" o.c. maximum spacing.

D. (05.5100.34) Fabricated parallel guard rail
   1. Attached to stair landing, 4" o.c. maximum spacing.

E. (05.5100.50) Cast aluminum nosing, with abrasive tread.

2.02 METAL STAIRS - GENERAL

A. Metal Stairs: Provide stairs of the design specified, complete with landing platforms, vertical and horizontal supports, railings, and guards, fabricated accurately for anchorage to each other and to building structure.
   1. Regulatory Requirements: Provide stairs and railings that comply with most stringent requirements of local, state, and federal regulations; where requirements of Contract Documents exceed those of regulations, comply with Contract Documents.
   2. Structural Design: Provide complete stair and railing assemblies that comply with the applicable local code.
   3. Dimensions: As indicated on drawings.
   4. Shop assemble components; disassemble into largest practical sections suitable for transport and access to site.
   5. No sharp or rough areas on exposed travel surfaces and surfaces accessible to touch.
   6. Separate dissimilar metals using paint or permanent tape.

B. Metal Jointing and Finish Quality Levels:
   1. Architectural: All joints as inconspicuous as possible, whether welded or mechanical.
      a. Welded Joints: Continuously welded and ground smooth and flush.
      b. Mechanical Joints: Butted tight, flush, and hairline; concealed fastenings only.
      c. Exposed Edges and Corners: Eased to small uniform radius.
      d. Metal Surfaces to be Painted: Sanded or ground smooth, suitable for highest quality gloss finish.
   2. Commercial: Exposed joints as inconspicuous as possible, whether welded or mechanical; underside of stair not covered by soffit IS considered exposed to view.
      a. Welded Joints: Intermittently welded on back side, filled with body putty, and sanded smooth and flush.
      b. Welds Exposed to View: Ground smooth and flush.
      c. Mechanical Joints: Butted tight, flush, and hairline.
      d. Bolts Exposed to View: Countersunk flat or oval head bolts; no exposed nuts.
      e. Exposed Edges and Corners: Eased to small uniform radius.
      f. Metal Surfaces to be Painted: Sanded or ground smooth, suitable for satin or matte finish.
   3. Service: Exposed joints tight with face surfaces aligned; underside of stair not covered by soffit is not considered exposed to view.
      a. Welded Joints: Welded on back side wherever possible.
      b. Welds Exposed to View: Ground smooth; not required to be flush.
      c. Bolts Exposed to View: Countersunk flat or oval head bolts; no exposed nuts or screw threads.
      d. Metal Surfaces to be Painted: Sanded smooth, suitable for satin or matte finish.

C. Fasteners: Same material or compatible with materials being fastened; type consistent with design and specified quality level.

D. Anchors and Related Components: Same material and finish as item to be anchored, except where specifically indicated otherwise; provide all anchors and fasteners required.

2.03 METAL STAIRS WITH CONCRETE TREADS

A. Jointing and Finish Quality Level: Architectural, as defined above.

B. Risers: Closed.

C. Treads: Metal pan with field-installed concrete fill.
   1. Concrete Depth: 1-1/2 inches (38 mm), minimum.
   2. Tread Pan Material: Steel sheet.
   3. Tread Pan Thickness: As required by design; 14 gauge, 0.075 inch (1.9 mm) minimum.
   4. Concrete Reinforcement: fibermesh.
   5. Concrete Finish: Steel troweled.

D. Risers: Same material and thickness as tread pans.
   1. Riser/Nosing Profile: Vertical riser with underside of nosing sloped up from bottom of tread pan at not less than 60 degrees from horizontal, with rounded top of nosing of minimum radius.
   2. Imbedded abrasive steel nosing.

E. Stringers: as indicated on drawings.
   1. Stringer Depth: As indicated on drawings.
   2. End Closure: Sheet steel of same thickness as risers welded across ends.

F. Landings: Similar construction, using corrugated steel decking, supported and reinforced as required to achieve design load capacity.

G. Railings: Steel pipe railings.

H. Finish: Shop- or factory-prime painted.

2.04 METAL STAIRS WITH GRATING TREADS

A. Mezzanine stairs:
   1. Jointing and Finish Quality Level: Industrial, as defined above.
   2. Risers: Closed.
   3. Treads: Steel bar grating.
      a. Grating Type: Welded.
      b. Bearing Bar Depth: 3/4 inch (19 mm), minimum.
      c. Top Surface: Standard.
      d. Nosing: Checkered plate.
      e. Nosing Width: 1-1/4 inch (32 mm), minimum.
      f. Anchorage to Stringers: End plates welded to grating, bolted to stringers.
   4. Stringers: Rolled steel channels.
      a. Stringer Depth: As indicated on drawings.
      b. End Closure: Sheet steel, 14 guage, 0.075 inch (1.9 mm) minimum; welded across ends.
   5. Railings: Steel pipe railings.
   6. Finish: Shop- or factory-prime painted.

2.05 HANDRAILS AND GUARDS

A. Wall-Mounted Rails: Round pipe or tube rails unless otherwise indicated.
   1. Outside Diameter: 1-1/4 inch (32 mm), minimum, to 1-1/2 inches (38 mm), maximum.

B. Guards:
   1. Top Rails: Round pipe or tube rails unless otherwise indicated.
      a. Outside Diameter: 1-1/4 inch (32 mm), minimum, to 1-1/2 inches (38 mm), maximum.
   2. Infill at Picket Railings: Vertical pickets.
      a. Horizontal Spacing: Maximum 4 inches (100 mm) on center.
      b. Material: Solid steel bar.
      c. Shape: Square.
      d. Size: 1/2 inch (13 mm) square.

e. Top Mounting: Welded to underside of top rail.
f. Bottom Mounting: As indicated on drawings.

3. Infill at Pipe Railings: Pipe or tube rails sloped parallel to stair.
   a. Outside Diameter: 1 inch (25 mm).
   b. Material: Steel pipe or tube, round.
   c. Vertical Spacing: Maximum 4 inches (100 mm) on center.
   d. Jointing: Welded and ground smooth and flush.
4. End and Intermediate Posts: Same material and size as top rails.
   a. Horizontal Spacing: As indicated on drawings.
   b. Mounting: Welded to top surface of stringer.

2.06 MATERIALS

A. Steel Sections: ASTM A36/A36M.

B. Steel Tubing: ASTM A500/A500M or ASTM A501/A501M structural tubing, round and shapes as indicated.

C. Steel Plates: ASTM A6/A6M or ASTM A283/A283M.

D. Pipe: ASTM A53/A53M Grade B Schedule 40, black finish.

E. Ungalvanized Steel Sheet: Hot- or cold-rolled, except use cold-rolled where finished work will be exposed to view.
   1. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Designation CS (commercial steel).
   2. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Designation CS (commercial steel).

F. Gratings: Bar gratings that comply with NAAMM MBG 531 or NAAMM MBG 532, whichever applies based on bar sizes.

G. Concrete Fill: Portland cement Type I, 3000 psi (20 MPa) 28 day strength, 4 inch (100 mm) slump.

H. Concrete Reinforcement: fibermesh.

2.07 ACCESSORIES

A. Factory Fabricated Stair Tread and Nosing:
   1. Materials: Cast Aluminum.
      a. Tread Abrasive: Cross-hatched silicon carbide abrasive 20 grit.
   2. Manufacturers:
      a. Nystrom, Inc: www.nystrom.com/#sle.
      b. Balco Incorporated: www.balcousa.com.
      c. American Safety Tread: www.americansafetytread.com
         1) Style: cast in place; Balco R-300 Single Component, 3" wide, set back ribbed abrasive.
      d. Substitutions: See Section 016000 - Product Requirements.

B. Steel Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, and galvanized to ASTM A153/A153M where connecting galvanized components.

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

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

2.08 SHOP FINISHING

A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

B. Do not prime surfaces in direct contact with concrete or where field welding is required.

C. Prime Painting: Use specified shop- and touch-up primer.
   1. Preparation of Steel: In accordance with SSPC-SP 2 Hand Tool Cleaning.
   2. Number of Coats: One.

PART 3 EXECUTION

3.01 PREPARATION

A. When field welding is required, clean and strip primed steel items to bare metal.

3.02 INSTALLATION

A. Install components plumb and level, accurately fitted, free from distortion or defects.

B. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Provide welded field joints where specifically indicated on drawings. Perform field welding in accordance with AWS D1.1/D1.1M.

D. Other field joints may be either welded or bolted provided the result complies with the limitations specified for jointing quality levels.

E. Obtain approval prior to site cutting or creating adjustments not scheduled.

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

END OF SECTION

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SECTION 055213
PIPE AND TUBE RAILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall mounted handrails.

1.02 RELATED REQUIREMENTS

A. Section 061000 - Rough Carpentry: Blocking

1.03 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum 2014 (2015 Errata).

B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.

C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2020.

D. ASTM B241/B241M - Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube 2016.

E. ASTM B429/B429M - Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube 2020.

F. ASTM B483/B483M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Tubes for General Purpose Applications 2020.

G. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings 2013, with Editorial Revision.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

PART 2 PRODUCTS

2.01 PIPE AND TUBE RAILINGS

A. (05.5213.01) Aluminum fabricated pipe railing
   1. Decorative stand alone railing and guardrail systems

B. (05.5213.10) Removable guardrail; black iron schedule 80 pipe, 1-1/2" diameter top and intermediate rail as detailed.

C. (05.5213.11) Non-removable guardrail; black iron schedule 80 pipe, 1-1/2" diameter top and intermediate rail as detailed.

D. (05.5213.12) Fabricated facia bracket; for removable guardrail.

E. (05.5213.13) Fabricated facia bracket; for non-removable guardrail.

F. (05.5213.14) Fabricated floor bracket; for removable guardrail.

G. (05.5213.15) Fabricated floor bracket; for non-removable guardrail.

H. (05.5213.50) Type 2 Handrail
   1. (05.5213.51) 1-1/2" diameter steel tubing guard rail; epoxy paint.
   2. (05.5213.52) 1-1/2" diameter steel tubing mid rail; epoxy paint.
   3. (05.5213.53) 1-1/2" diameter steel tubing railing post; 4'-0" o.c. max; epoxy paint.
   4. (05.5213.54) Continuous 1/4" x 4" kick / toe plate, epoxy paint.
   5. (05.5213.55) 1-1/2" pipe rail facia receiver bracket, epoxy paint.
      a. (05.5213.56) WT4 x 9 x 7" long w/ (4)) 1/2" dia. thru bolts
      b. (05.5213.57) 2" diameter steel tubing x 1'-0" long w (1) 1/2" dia. setting bolt

2.02 MANUFACTURERS

A. Handrails and Railings:

1. C.R. Laurence Company, Inc; CRL Aluminum Component Railing System (ACRS): www.crl-arch.com/sle.
2. KaneSterling: www.sterlingdula.com.
3. The Wagner Companies: www.wagnercompanies.com.
4. Substitutions: See Section 016000 - Product Requirements.

2.03 RAILINGS - GENERAL REQUIREMENTS

A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of applicable local code.

B. Distributed Loads: Design railing assembly, wall rails, and attachments to resist distributed force of 75 pounds per linear foot (1095 N/m) applied to the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E935

C. Concentrated Loads: Design railing assembly, wall rails, and attachments to resist a concentrated force of 200 pounds (890 N) applied at any point on the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E935

D. Allow for expansion and contraction of members and building movement without damage to connections or members.

E. Dimensions: See drawings for configurations and heights.
1. Top Rails and Wall Rails: 1-1/2 inches (38 mm) diameter, round.
2. Intermediate Rails: 1-1/2 inches (38 mm) diameter, round.
3. Posts: 1-1/2 inches (38 mm) diameter, round.

F. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.

G. Provide slip-on non-weld mechanical fittings to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.

2.04 ALUMINUM MATERIALS

A. Aluminum Pipe: Schedule 40; ASTM B429/B429M, ASTM B241/B241M, or ASTM B483/B483M.

B. Straight Splice Connectors: Concealed spigot; cast aluminum.

C. Exposed Fasteners: No exposed bolts or screws.

2.05 STEEL RAILING SYSTEM

A. Steel Pipe: ASTM A53/A53M Grade B Schedule 80, black finish.

B. Welding Fittings: Factory- or shop-welded from matching pipe or tube; seams continuously welded; joints and seams ground smooth.

C. Exposed Fasteners: Flush countersunk screws or bolts; consistent with design of railing.

D. Straight Splice Connectors: Steel concealed spigots.

2.06 FABRICATION

A. Accurately form components to suit specific project conditions and for proper connection to building structure.

B. Fit and shop assemble components in largest practical sizes for delivery to site.

C. Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.

D. Welded Joints:
1. Exterior Components: Continuously seal joined pieces by intermittent welds and plastic filler. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.
2. Interior Components: Continuously seal joined pieces by intermittent welds and plastic filler.

3. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

2.07 ALUMINUM FINISHES

A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils (0.018 mm) thick.

B. Touch-Up Materials: As recommended by coating manufacturer for field application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.

C. Install railings in compliance with ADA Standards for accessible design at applicable locations.

D. Anchor railings securely to structure.

3.03 TOLERANCES

A. Maximum Variation from Plumb: 1/4 inch (6 mm) per floor level, non-cumulative.

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

C. Maximum Out-of-Position: 1/4 inch (6 mm).

END OF SECTION

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SECTION 055217
ROOF TOP FALL PROTECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Roof accessories including the following:
   1. Non-penetrating railing system for roof edge fall protection.
   2. Permanent guard rails.
   3. Roof hatch guarding.
   4. Fixed ladder guarding.
   5. Visual warning lines.
   6. Skylight guarding.
   7. Fixed and caged ladders.
   8. Mobile fall arrest and restraint systems.

1.02 REFERENCE STANDARDS

A. 29 CFR 1910.23 - Ladders current edition.

B. 29 CFR 1910.29 - Fall Protection Systems and Falling Object Protection - Criteria and Practices Current Edition.

C. 29 CFR 1926 - Safety and Health Regulations for Construction Current Edition.

D. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements 2018.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

C. Shop Drawings: Drawings showing plans, elevations, sections and details of components. Show member sizes and part identification, fasteners, anchors, fittings and evidence of compliance with structural performance requirements.

D. Manufacturer's Certificates:

E. Certify that Railings and Base Castings are made in USA. Provide steel mill and foundry certificates for verification prior to shipment.
   1. Manufacturer must be American Welding Society Welding Certified for Welding Standards AWS D1.1 and AWS D1.3. Third party qualification documentation required prior to shipment.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the job site in good condition and adequately protected against damage as handrails are a finished product.

B. Inspect rail sections for damage before signing the receipt from the trucking company. Truck driver must note damaged goods on the bill of lading if damaged product is found.

C. Store products in manufacturer's unopened packaging until ready for installation.

D. Products to be palletized and labeled by roof level or designated drop zone.

1.05 FIELD CONDITIONS

A. Field Measurements: Where handrails and railings are indicated to fit to other construction, check actual dimensions of other construction by accurate field measurements before fabrication.

1.06 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide two-year manufacturer warranty. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 ROOF TOP FALL PROTECTION ELEMENTS

A. (05.5217.20) Fixed ladder guard; SRC LadderGuard Lite 7.5 Fixed Ladder Guarding System.
   1. Safety Rail Company,; www.safetyrailcompany.com.

2.02 MANUFACTURERS

A. Acceptable Manufacturer: Safety Rail Company, which is located at: 4244 Shoreline Dr.; Spring Park, MN 55384; Toll Free Tel: 888-434-2720; Fax: 888-471-4931; Email: jim.sidla@safetyrailcompany.com. Web: www.safetyrailcompany.com

B. Substitutions: See Section 016000 - Product Requirements.

2.03 FIXED LADDER GUARDING:

A. Provide Safety Rail Company SRC roof ladder guarding including railings, bases, accessories and fittings.

B. Product: SRC LadderGuard Lite 7.5 Fixed Ladder Guarding System.
   1. Provides a 36 in (914 mm) wide passageway and extends 7-1/2 ft (2.29 m) onto the roof. Adjustable spanner bars extend the reach another 40 in (1016 mm) allowing for a full length of 10 ft (3.05 m) control zone extending from the ladder.

C. Non-penetrating system attaches to the vertical rails of the existing ladder.

D. OSHA-compliant fall protection per 29 CFR 1910.29, 29 CFR 1910.23 (c) (1), and29 CFR 1926.502.

E. Self-closing gate included.

F. Finish: Steel surfaces: Hot dip zinc galvanized.

G. Color: None.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Engineer of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install per manufacturer's instructions.

3.04 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 062000
FINISH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Finish carpentry items.

B. Hardware and attachment accessories.

1.02 RELATED REQUIREMENTS

A. Section 061000 - Rough Carpentry: Support framing, grounds, and concealed blocking.

B. Section 064100 - Architectural Wood Casework: Shop fabricated custom cabinet work.

1.03 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition 2014, with Errata (2016).

B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.1 2017, with Errata (2019).

C. BHMA A156.9 - American National Standard for Cabinet Hardware 2015.

D. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood 2016.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with plumbing rough-in, electrical rough-in, and installation of associated and adjacent components.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data:
   1. Provide manufacturer's product data, storage and handling instructions for factory-fabricated units.
   2. Indicate dimensions.

C. Samples: Submit two samples of finish plywood, 12 x 12 inch (304 mm) in size illustrating wood grain and specified finish.

1.06 QUALITY ASSURANCE

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

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect from moisture damage.

PART 2 PRODUCTS

2.01 FINISH CARPENTRY ITEMS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

2.02 INTERIOR WOODWORK ITEMS:

2.03 BACKER AND MOUNTING BOARDS

A. (06.2000.101) Electrical panel board; 3/4" x '4' x 8' ACX fire rated plywood
   1. Primed and painted per finish schedule.

B. (06.2000.102) Communication / data equipment board; 3/4" x '4' x 8' ACX fire rated plywood
   1. Primed and painted per finish schedule.

C. (06.2000.103) Fire equipment board; 3/4" x '4' x 8' ACX fire rated plywood
   1. Primed and painted per finish schedule.

D. (06.2000.104) Control equipment board; 3/4" x '4' x 8' ACX fire rated plywood
   1. Primed and painted per finish schedule.

E. (06.2000.106) Equipment board; 3/4" thick ACX fire rated plywood; size as indicated.

1. Primed and painted per finish schedule.

2.04 LUMBER MATERIALS

A. Hardwood Lumber: poplar, birch, maple or as indicated on drawings species, sawn, maximum moisture content of 6 percent.

2.05 SHEET MATERIALS

A. Hardwood Plywood: Face species as indicated, plain sawn, veneer core; HPVA HP-1 Front Face Grade AA, Back Face Grade 1, glue type as recommended for application.

2.06 FABRICATION

A. Shop assemble work for delivery to site, permitting passage through building openings.

B. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

3.02 INSTALLATION

A. Install custom fabrications in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.

B. Set and secure materials and components in place, plumb and level.

C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch (0.79 mm). Do not use additional overlay trim to conceal larger gaps.

3.03 TOLERANCES

A. Maximum Variation from True Position: 1/16 inch (1.6 mm).

B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch (0.79 mm).

END OF SECTION

SECTION 072110
THERMAL INSULATION - MINERAL WOOL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Mineral wool insulation for the following applications:
   1. Thermal and acoustical insulation.
   2. Perimeter fire containment systems.
   3. Fire resistive joint systems in rated assemblies.
   4. Firestopping of through penetrations in rated assemblies.

1.02 REFERENCE STANDARDS

A. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation 2014 (Reapproved 2019).

B. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing 2017.

C. ASTM C1104/C1104M - Standard Test Method for Determining the Water Vapor Sorption of Unfaced Mineral Fiber Insulation 2019.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.

E. CAN/ULC-S102.2 - Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Covering and Miscellaneous Materials and Assemblies 2018 (Revised 2019).

F. ISO 14025 - Environmental labels and declarations -- Type III environmental declarations -- Principles and procedures 2006 (Confirmed 2020).

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including preparation instructions and recommendations, storage and handling requirements, and installation methods.

C. Shop Drawings: Submit manufacturer's shop drawings describing the type and location of each product specified.

D. Verification Samples: For each finish product specified, two samples, minimum size 6 inches square, representing actual product.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: The installation work of this Section shall be performed by an experienced contractor with a minimum of 2 years experience installing similar assemblies.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to the job site in original packages, containers, or bundles bearing the brand name and manufacturer's identification.

B. Storage: Store materials in dry locations with adequate ventilation, free from water, and in such a manner to permit easy access for inspection and handling.

C. Handling: Handle using procedures recommended by the manufacturer for materials and personnel.

1.06 WARRANTY

A. Warranty: Provide manufacturer’s standard limited warranty against manufacturing defects.

PART 2 PRODUCTS

2.01 THERMAL AND ACOUSTICAL INSULATION

A. (07.2110.01) 1" mineral wool insulation.

B. (07.2110.02) 1-1/2" mineral wool insulation.

C. (07.2110.03) 2" mineral wool insulation.

D. (07.2110.04) 2-1/2" mineral wool insulation.

E. (07.2110.05) 3" mineral wool insulation.

F. (07.2110.06) 3-1/2" mineral wool insulation.

G. (07.2110.07) 4" mineral wool insulation.

H. (07.2110.08) 5" mineral wool insulation.

I. (07.2110.09) 5-1/2" mineral wool insulation.

J. (07.2110.10) 6" mineral wool insulation.

K. (07.2110.11) Mineral wool fire safing between metal track/stud and structure.

2.02 MANUFACTURERS

A. Basis-of-Design Manufacturer: Thermafiber, Inc. (an Owens Corning company), One Owens Corning Parkway, Toledo, OH 43659. Toll free 888-834-2371, Fax 260-563-8979, www.thermafiber.com.

B. Substitutions: See Section 016000 - Product Requirements.

2.03 THERMAL AND ACOUTSTICAL INSULATION

A. Product: Thermafiber FireSpan 90 Insulation.
   a. R-Value: 4.3 per inch.
   b. Facing: Unfaced.
   c. Facing: Foil Faced.
   d. Density: 8.0 pcf (nominal).
   e. This product qualifies under the Department of Homeland Security SAFETY Act designation which provides commercial building professions and building owners liability protection in the event of a foreign/domestic act of terrorism.

B. Product: Thermafiber FireSpan 40 Insulation.
   1. R-Value: 4.3 per inch.
   2. Facing: Unfaced.
   3. Facing: Foil Faced.
   4. Density: 4.0 pcf (nominal).
   5. This product qualifies under the Department of Homeland Security SAFETY Act designation which provides commercial building professions and building owners liability protection in the event of a foreign/domestic act of terrorism.

C. Product: Thermafiber UltraBatt; unfaced
   1. Formaldehyde Free (FF)
   2. R-Value: R-10, R-15, R-23, R-24, and R30 as applicable
   3. Surface Burning Characteristics: Tested in accordance with ASTM E84.
      a. Unfaced: Flame Spread 5 and Smoke Developed 5

D. Product: Thermafiber UltraBatt; foil faced.
   1. R-Value: R-10, R-15, R-23, R-24, and R30 as applicable.

E. Product: Thermafiber Sound Attenuation Fire Blanket (SAFB); unfaced.
   1. Density - 1 Inch Thick: 4 pcf, nominal.
   2. Density - Greater Than 1 Inch Thick: 2.5 pcf, nominal.

F. Product: Thermafiber Sound Attenuation Fire Blanket (SAFB); unfaced
   1. Formaldehyde Free (FF)
   2. Density – 1 Inch Thick: 4 pcf nominal.
   3. Density – Greater Than 1 Inch Thick: 2.5 pcf, nominal.
   4. GREENGUARD GOLD Certified
   5. ULE Validated Formaldehyde Free

G. Surface Burning Characteristics (excluding UltraBatt FF): Tested in accordance with ASTM E84.
   1. Unfaced: Flame Spread 0 and Smoke Developed 0,
   2. Foil Faced: Flame Spread 25 and Smoke Developed 0.

H. Corrosivity: Non-corrosive, when tested in accordance with ASTM C665.

I. Fiber Type: EPA Choice fiber; minimum 75 percent pre-consumer recycled content; complies with EPA Preference Program.

J. Fiber Type: Standard fiber; 70 percent pre-consumer recycled content.

K. Post-Consumer Recycled Content: 0 percent.

L. UL Certified Environmental Product Declaration in accordance with ISO 14025. Applies to all products except SAFB FF and UltraBatt FF.

2.04 RAIN SCREEN / CAVITY WALL CONTINUOUS INSULATION:

A. Product: Thermafiber RainBarrier 45, non-combustible, semi-rigid mineral wool insulation board that is water repellent and resists temperatures above 2,000 degrees F, meets ASTM C612, IVA.
   1. R-value: 4.3 per inch.
   2. Facing: Unfaced.
   3. Density: 4.5 pcf.

B. Thermafiber RainBarrier HD
   1. R-value: 4.3 per inch
   2. Facing: Unfaced.
   3. Density: 6.0 pcf.

C. Surface Burning Characteristics: Tested in accordance with ASTM E84, Unfaced Flame Spread 0 and Smoke Developed 0.

D. Moisture Resistance: Absorption of less than 0.03 percent by volume, when tested in accordance with ASTM C1104/C1104M.

E. Corrosivity: Non-corrosive, when tested in accordance with ASTM C665.

F. Fiber Type: EPA Choice fiber; minimum 75 percent pre-consumer recycled content; complies with EPA Preference Program.

G. Fiber Type: Standard fiber; 70 percent pre-consumer recycled content.

H. Post-Consumer Recycled Content: 0 percent.

I. UL Certified Environmental Product Declaration in accordance with ISO 14025.

J. Hardware: RainBarrier Insulation Retaining Clip for securing RainBarrier continuous insulation to exterior substrate; recommended by manufacturer as compatible with multiple types of masonry and façade tie systems.

2.05 MULTI-PURPOSE THERMAL AND ACOUSTICAL INSULATION PRODUCT USED WHERE FIRE RATED ASSEMBLY IS NOT REQUIRED:.

A. Product: Thermafiber VersaBoard, non-combustible, semi-rigid mineral wool insulation board, water repellent. Fire resistant to temperatures above 2,000 degrees F.
   1. Facing: Unfaced.
   2. Facing: ASJ Facing.
   3. Facing: Black mat.
   4. Facing: White mat.
   5. Surface Burning Characteristics: Tested in accordance with ASTM E84. Unfaced, Flame Spread 0 and Smoke Developed 0. Foil Faced, Flame Spread 25 and Smoke Developed 0.

B. Product: Thermafiber VersaBoard 35, complies with ASTM C612 Type IA.
   1. R-Value: 4.2 per inch.
   2. Density: 3.5 pcf (actual).

C. Product: Thermafiber VersaBoard 40, complies with ASTM C612 Type IA, IB, II, III, and IVA.
   1. R-Value: 4.3 per inch.
   2. Density: 4.0 pcf (actual).

D. Product: Thermafiber VersaBoard 60, complies with ASTM C612 Type IA, IB, II, III, and IVA.
   1. R-Value: 4.3 per inch.
   2. Density: 6.0 pcf (actual).

E. Product: Thermafiber VersaBoard 80, complies with ASTM C612 Type IA, IB, II, III, and IVA.
   1. R-Value: 4.3 per inch.
   2. Density: 8.0 pcf (actual).

F. Moisture Resistance: Absorption of less than 0.03 percent by volume, when tested in accordance with ASTM C1104.

G. Corrosivity: Non-corrosive, when tested in accordance with ASTM C665.

H. Fiber Type: EPA Choice fiber; minimum 75 percent pre-consumer recycled content; complies with EPA Preference Program.

I. Fiber Type: Standard fiber; 70 percent pre-consumer recycled content.

J. Post-Consumer Recycled Content: 0 percent.

K. UL Certified Environmental Product Declaration in accordance with ISO 14025.

2.06 ACOUSTICAL INSULATION FOR FIRE RATED INTERIOR PARTITION WALLS AND CEILINGS: UNFACED.

A. Product: Thermafiber Sound Attenuation Fire Blanket (SAFB).
   1. Density - 1 inch Thick: 4.0 pcf, nominal.
   2. Density - Thicker Than 1 Inch: 2.5 pcf, nominal.

B. Product: Thermafiber Sound Attenuation Fire Blanket (SAFB)
   1. Formaldehyde Free (FF)
   2. Density - 1 inch Thick: 4.0 pcf, nominal.
   3. Density - Thicker Than 1 Inch: 2.5 pcf, nominal
   4. GREENGUARD GOLD Certified
   5. ULE Validated Formaldehyde Free

C. Product: Thermafiber Creased Sound Attenuation Fire Blanket (SAFB).
   1. Density - 2.5 pcf, nominal.

D. Product: Thermafiber Creased Sound Attenuation Fire Blanket (SAFB)
   1. Formaldehyde Free (FF)
   2. Density - 2.5 pcf, nominal
   3. GREENGUARD GOLD Certified
   4. ULE Validated Formaldehyde Free
   5. Surface Burning Characteristics: Flame Spread 0 and Smoke Developed 0; tested in accordance with ASTM E84.
   6. Recycled Content: 70 percent, minimum, pre-consumer.
   7. UL Certified Environmental Product Declaration in accordance with ISO 14025. Applies to all products except SAFB FF.
   8. Corrosivity: Non-corrosive, when tested in accordance with ASTM C665.

2.07 PERIMETER FIRE CONTAINMENT SYSTEMS

A. General: Provide where indicated for gaps between the perimeter edge of fire-resistance-rated floor assemblies and non-fire-resistance-rated exterior curtain walls.
   1. Provide a perimeter fire-containment system with the fire test response characteristics indicated, as determined by testing identical systems per the Underwriters Laboratories or Intertek (OPL) Laboratories, or another testing and inspecting agency accountable to authorities having jurisdiction.
   2. If no tested system exists, an engineering judgment provided by the manufacturer, 3rd party testing lab, or fire protection engineering firm that follows guidelines established by the International Firestop Council must accompany the design.
   3. For non-fire resistance rated floor assemblies add an approved material or assembly for retarding the passage of flame and hot gasses.

B. Curtain Wall Insulation:
   1. Product: Thermafiber FireSpan 90 Insulation; density of 8 pcf, nominal.
   2. Product: Thermafiber FireSpan 40 Insulation; density of 4.0 pcf, nominal.
   3. Minimum Thickness and Density as noted in tested and listed design.
   4. R-Value: 4.3 per inch.

5. Facing: Unfaced.
6. Facing: Foil Faced.
7. Surface-Burning Characteristics: Tested in accordance with ASTM E84. Unfaced, maximum flame spread 0 and smoke-developed of 0; foil faced, maximum flame spread 25 and smoke-developed of 0.
8. Corrosivity: Non-corrosive, when tested in accordance with ASTM C665
9. Fiber Type: EPA Choice Fiber; minimum 75 percent pre-consumer recycled content; complies with EPA Preference Program.
10. Fiber Type: Standard fiber; 70 percent pre-consumer recycled content
11. Post-Consumer Recycled Content: 0 percent.
12. UL Certified Environmental Product Declaration in accordance with ISO 14025.

C. Safing Insulation:
1. Product: Thermafiber Safing Insulation. Designated Type SAF in UL Fire Resistance Directory.
2. R-Value: 4.3 per inch.
3. Facing: Unfaced.
4. Facing: Foil Faced.
5. Density: 4.0 pcf (actual).
6. Density: 6.0 pcf (actual).
7. Minimum Thickness and Density as noted in tested and listed design.
8. Surface-Burning Characteristics: Tested in accordance with ASTM E84. Unfaced, maximum flame spread 0 and smoke-developed of 0; foil faced, maximum flame spread 25 and smoke-developed of 0.
9. Corrosivity: Non-corrosive, when tested in accordance with ASTM C665.
10. Fiber Type: EPA Choice Fiber; minimum 75 percent pre-consumer recycled content; complies with EPA Preference Program.
11. Fiber Type: Standard fiber; 70 percent pre-consumer recycled content
12. Post-Consumer Recycled Content: 0 percent.
13. UL Certified Environmental Product Declaration in accordance with ISO 14025.

D. Safing Clips: Z-Shaped galvanized steel clips formed from 1 inch wide strips of 20 gauge galvanized steel; 3 inches high with 2 inch and 3 inch upper and lower horizontal legs. Use where required by specific UL or OPL/Intertek design.

E. Hardware: Thermafiber Impasse hardware for attaching curtain wall insulation or other mechanical fasteners as approved by the Engineer and Manufacturer.

F. Mullion Covers: Thermafiber FireSpan 90 Insulation for protection of mullions. Refer to specific UL/Intertek designs for size of mullion covers.

G. Backer / Reinforcement Member: Thermafiber Impasse T-Bar or galvanizes steel channel or angle (see specific listing for appropriate gauge of steel) approved by the primary manufacturer. Place horizontally at the safe-off line to support the curtain wall insulation to prevent bowing of curtain wall insulation caused by compression fitting of the Safing insulation. See specific listed design for system requirements.

H. Smoke Barrier: Smoke sealant as listed in the appropriate fire tested assembly.

I. Vapor Retarder Tape: Compatible with specified facer and comparable perm rating. For taping insulation joints and repairing tears.

2.08 FIRE RESISTIVE JOINT SYSTEMS IN RATED ASSEMBLIES

A. Insulation for Joint Packing:
1. Product for Construction Joints: Thermafiber Safing Insulation - Type SAF.
2. Product for Head of Wall Applications: Thermafiber Top-Stop Insulation.
3. Facing: Unfaced.
4. Surface Burning Characteristics: Flame Spread 0 and Smoke Developed 0; tested in accordance with ASTM E84.
5. Corrosivity: Non-corrosive, when tested in accordance with ASTM C665.
6. Fiber Type: Standard fiber; minimum 75 percent pre-consumer recycled content; complies with EPA Preference Program.
7. Post-Consumer Recycled Content: 0 percent.

8. UL Certified Environmental Product Declaration in accordance with ISO 14025.

B. Smoke Barrier Sealant: Smoke sealant as listed in the appropriate fire tested assembly.

2.09 FIRESTOPPING OF THROUGH PENETRATIONS IN RATED ASSEMBLIES

A. Safing Insulation – Type SAF:
1. Product: Thermafiber Safing Insulation; unfaced.
2. Density: 4.0 pcf (actual).
3. Density: 6.0 pcf (actual).
4. Minimum Thickness and Density as noted in tested and listed design.
5. Surface Burning Characteristics: Flame Spread 0 and Smoke Developed 0; tested in accordance with ASTM E84.
6. Corrosivity: Non-corrosive, when tested in accordance with ASTM C665.
7. Fiber Type: Standard fiber; minimum 75 percent pre-consumer recycled content; complies with EPA Preference Program.
8. Post-Consumer Recycled Content: 0 percent.
9. UL Certified Environmental Product Declaration in accordance with ISO 14025.

B. Smoke Barrier Sealant: Smoke sealant as listed in the appropriate fire tested assembly.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine the areas and conditions under which work of this section will be installed. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Comply with tested and listed systems. Install products in proper relationship with each other and adjacent construction and as follows:
1. Backer Reinforcement Members for Perimeter Fire Containment System:
   a. Install backer reinforcement member in accordance with the listed tested system.
   b. Install Thermafiber Impasse T-Bar or an approved light steel angle or channels (see specific listing for appropriate gauge of steel), placed horizontally at the safing line, attached to the vertical mullions either within the insulation at a horizontal splice, or behind the insulation and mechanically attached to vertical mullions.
   c. Install to prevent the bowing of the curtain wall insulation due to the compression fit of the safing insulation.

B. Curtain Wall Insulation:
1. Install curtain wall insulation in accordance with Underwriters Laboratories / Intertek (OPL) Laboratories listed system and manufacturer's instructions.
2. Install backer bar assembly in accordance with the listed and tested design. Not applicable when the Thermafiber No Backer Bar system is specified.
3. Fasten insulation in place with mechanical fasteners within the mullions and transoms (spandrel area), spaced at intervals recommended by listed and tested assembly to hold insulation securely in place without touching the exterior wall. One inch air space must be maintained.
4. Provide Thermafiber Impasse hardware or mechanical fasteners as approved by Engineer and manufacturer.
5. Comply with specific listed and tested assemblies for mechanical fastener requirements.
6. Maintain cavity width of dimension indicated between insulation and exterior wall.

C. Safing Insulation – Type SAF:
1. Install safing insulation of proper size in safe off area between curtain wall insulation and floor slab as prescribed by the listed and tested assembly. Safing insulation direction and compression as well as the absence of safing Z-clips are prescribed by the listed and tested assembly.
2. Install safing insulation of proper density and size into perimeter joint, construction joints (head-of-wall, floor-to-floor, floor-to-wall, etc.) as prescribed by the listed and tested assembly.

3. Install safing insulation of proper density and size into poke-throughs and penetrations as prescribed by the listed and tested assembly.

D. Smoke Barrier System:
1. Utilize foil faced FireSpan curtain wall Insulation with Thermafiber Safing Insulation.
2. Apply approved smoke sealant in accordance with the tested assembly.
3. Install safing insulation of proper density and size as prescribed by the listed and tested assembly.
4. Install safing insulation of proper density and size into poke-throughs and penetrations as prescribed by the tested assembly.
5. Apply approved smoke sealant in accordance with the tested assembly.

E. Vapor Retarders:
1. Seal all joints in curtain wall insulation or exterior wall insulation with vapor retarder tape.
2. Application of vapor retarder must be directed by Architect of Record or Mechanical Engineer of project.
3. For continuous vapor barrier repair all tears in insulation foil facing with vapor retarder tape.

END OF SECTION

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SECTION 072140
FOAMED-IN-PLACE MASONRY WALL INSULATION

PART 1 GENERAL

1.01 SUMMARY

A. Extent of insulation work is shown on drawings and indicated by provisions of this section.

B. Applications of insulation specified in this section include the following:
   1. Foamed-In-Place masonry insulation for thermal, sound and fire resistance values.

1.02 SUBMITTALS

A. Product and technical presentation as provided by the manufacturer.

B. Certified Test Reports: With product data, submit copies of certified test reports showing compliance with specified performance values, including R-values, fire performance and sound abatement characteristics.

C. Material Safety Data Sheet: Submit Material Safety Data Sheet complying with OSHA Hazard Communication Standard, 29 CRF 1910 1200.

1.03 QUALITY ASSURANCE

A. Manufacturing Standards: Provide insulation produced by a single and approved manufacturer. The product must come from the manufacturer pre-mixed to ensure consistency.

B. Installer Qualifications for Foamed-In-Place Masonry Insulation: Engage an experienced dealer/applicator who has been trained and licensed by the product manufacturer and which has not less than three years direct experience in the installation of the product used.

C. Warranty: Upon request, a one year product and installation warranty will be issued by both the manufacturer and installer.
   1. Foamed-In-Place

D. Fire Performance Characteristics: Provide insulation materials which are identical to those whose fire performance characteristics, as listed for each material or assembly of which insulation is a part, have been determined by testing, per methods indicated below, by a testing agency acceptable to authorities having jurisdiction.
   1. Product must be classified by Underwriters Laboratory (“UL”) as to Surface
   2. Burning Characteristics
   3. Surface Burning Characteristics: ASTM E-84

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturers of Foamed-In-Place Masonry Insulation: Subject to compliance with requirements, provide products from the following:
   1. "Core-Fill 500TM"; Tailored Chemical Products, P.O. Box 4186, Hickory, N.C. 28603, (800) 627-1687; www.core-fill 500.com

2.02 INSULATING MATERIALS

A. 07.2140.01: Cavity insulation; Core-Fill 500

B. General: Provide insulating materials which comply with requirements indicated for materials, compliance with referenced standards, and other characteristics.

C. Foamed-In-Place Masonry Insulation: Two component thermal insulation produced by combining a plastic resin and catalyst foaming agent surfactant which, when properly ratioed and mixed, together with compressed air produce a cold-setting foam insulation in the hollow cores of hollow unit masonry walls.
   1. Surface Burning Characteristics: Maximum flame spread, smoke developed and fuel contributed of 0, 5 and 0 respectively.
   2. Combustion Characteristics: Must be noncombustible, Class A building material.
   3. Thermal Values: "R" Value of 4.91/inch @ 32 degrees F mean; ASTM C-177.
   4. Sound Abatement: Minimum Sound Transmission Class ("STC") rating of 53 and a minimum Outdoor Indoor Transmission Class ("OITC") rating of 44 for 8" wall assembly (ASTM E 90-90).

a. Foamed-In-Place

PART 3 EXECUTION

3.01 INSPECTION AND PREPARATION

A. Application Assemblies:
   1. Block Walls: 6", 8", 10" or 12" concrete masonry units
   2. Cavity Walls: 2" cavity or greater

3.02 INSTALLATION OF FOAMED-IN-PLACE INSULATION

A. General: Install foamed-in-place insulation from interior, or as specified, prior to installation of interior finish work and after all masonry and structural concrete work is in place; comply with manufacturer's instructions.

B. Installation: Fill all open cells and voids in hollow concrete masonry walls where shown on drawings. The foam insulation shall be pressure injected through a series of 5/8" to 7/8" holes drilled into every vertical column of block cells (every 8" on center) beginning at an approximate height of four (4) feet from finished floor level. Repeat this procedure at an approximate height of ten (10) feet above the first horizontal row of holes (or as needed) until the void is completely filled. Patch holes with mortar and score to resemble existing surface.

END OF SECTION

SECTION 074213

INSULATED METAL WALL PANELS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Foamed-insulation-core concealed fastener metal wall panels, with related metal trim and accessories.

1.2 RELATED REQUIREMENTS

A. Division 05 Section "Structural Steel Framing" for steel framing supporting metal panels.

B. Division 05 Section "Cold-Formed Metal Framing" for cold-formed metal framing supporting metal panels.

C. Division 07 Section "Sheet Metal Flashing and Trim" for sheet metal flashing items in addition to items specified in this Section.

D. Division 07 Section "Metal Wall and Roof Panels" for factory-formed metal wall, roof, and soffit panels.

E. Division 13 Section "Metal Building Systems" for steel framing supporting metal panels.

1.3 REFERENCES

A. American Society of Civil Engineers (ASCE): www.asce.org/codes-standards:

1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

B. ASTM International (ASTM): www.astm.org:

1. ASTM A 653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
2. ASTM A 755 - Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
3. ASTM A 792 - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
4. ASTM A 240 – Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
5. ASTM C 518 - Standard Test Method for Steady State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
6. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus
7. ASTM D 1621 - Compressive Properties of Rigid Cellular Plastics.
8. ASTM D 1622 - Apparent Density of Rigid Cellular Plastics.
9. ASTM D 2244 - Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.
10. ASTM D 4214 - Test Methods for Evaluating Degree of Chalking of Exterior Paint Films.
11. ASTM D 6226 - Standard Test Method for Open Cell Content of Rigid Cellular Plastics
12. ASTM E 72 - Standard Test Methods of Conducting Strength Tests of Panels for Building Construction.
13. ASTM E 84 - Test Methods for Surface Burning Characteristics of Building Materials.
14. ASTM E 283 - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
15. ASTM E 331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
16. ASTM E 1592 - Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference.

C. National Fire Protection Association (NFPA)

1. NFPA 259 – Test Method for Potential Heat of Building Materials.
2. NFPA 285 – Evaluation of Fire Propagation Characteristics of Exterior Non-Load Bearing Wall Assemblies.
3. NFPA 286 – Fire Test of Evaluating Conditions of Wall and Ceiling Finish to Roof Fire Growth.

1.4 QUALITY ASSURANCE

A. Manufacturer/Source: Provide metal panel assemblies and accessories from a single manufacturer approved under an accredited third-party quality control program

B. Manufacturer Qualifications: Approved manufacturer listed in this Section with minimum ten years' experience in the manufacturing of similar products and successful use in similar applications.

1. Approval of Comparable Products: Submit the following in accordance with project substitution requirements, within time allowed for substitution review:

    a. Product data, including certified independent test data indicating compliance with requirements.
    b. Samples of each component.
    c. Sample submittal from similar project.
    d. Project references: Minimum of five installations not less than five years old, with Owner and Architect contact information.
    e. Sample warranty.
    f. Certificate from an accredited third-party Quality Control Program.

2. Substitutions following award of contract are not allowed except as stipulated in Division 01 General Requirements
3. Approved manufacturers must meet separate requirements of Submittals Article.

C. Installer Qualifications: Experienced Installer certified by metal panel manufacturer with minimum of five years' experience with successfully completed projects of a similar nature and scope.

1. Installer's Field Supervisor: Experienced mechanic certified by metal panel manufacturer supervising work on site whenever work is underway.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Prior to erection of framing, conduct preinstallation meeting at site attended by Owner, Architect, metal panel installer, metal panel manufacturer's technical representative, inspection agency and related trade contractors.

1. Coordinate building framing in relation to metal panel system.
2. Coordinate openings and penetrations of metal panel system.

1.6 ACTION SUBMITTALS

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

B. Shop Drawings: Show layouts of metal panels. Include details of each condition of installation, panel profiles, and attachment to building. Provide details at a minimum scale 1-1/2-inch per foot of edge conditions, joints, fastener and sealant placement, flashings, openings, penetrations, and special details. Make distinctions between factory and field assembled work.

1. Include data indicating compliance with performance requirements.
2. Indicate points of supporting structure that must coordinate with metal panel system installation.

3. Include structural data indicating compliance with performance requirements and requirements of local authorities having jurisdiction.

C. Samples for Initial Selection: For each exposed product specified including sealants. Provide representative color charts of manufacturer's full range of colors.

D. Samples for Verification:

1. Provide 12-inch- (305 mm) long section of each metal panel profile.
2. Provide color chip verifying color selection.

1.7 INFORMATIONAL SUBMITTALS

A. Product Test Results: Indicating compliance of products with requirements.

B. Qualification Information: For Installer

C. Accreditation Certificate: Indicating that manufacturer is accredited under an accredited third-party Quality Control Program, including IAS AC472 and based upon chapter 17 of the International Building Code (IBC).

D. Warranty:

1. Submit manufacturer’s written two (2) year limited warranty providing panels to be free from defects in materials and workmanship, beginning from the date of substantial completion excluding coil coatings (paint finishes) that are covered under a separate warranty.
2. The installation contractor shall issue a separate warranty against defects in installed materials and workmanship, beginning from the date of substantial completion of the installation.

1.8 CLOSEOUT SUBMITTALS

A. Maintenance data.

B. Manufacturer's Warranty: Executed copy of manufacturer's warranty.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect products of metal panel system during shipping, handling, and storage to prevent staining, denting, deterioration of components or other damage. Protect panels and trim bundles during shipping. Protect painted surfaces with a protective covering before shipping.

1. Deliver, unload, store, and erect metal panels and accessory items without deforming panels or exposing panels to surface damage from weather or construction operations.
2. Store in accordance with Manufacturer's written instructions.
3. Shield foam insulated metal panels from direct sunlight until all components are installed.

1.10 WARRANTY

A. Special Manufacturer’s Warranty: Submit Manufacturer’s two (2) year limited warranty providing panels to be free from defects in materials and workmanship, beginning from the date of substantial completion excluding coil coatings (paint finishes) that are covered under a separate warranty.

B. The installation contractor shall issue a separate warranty against defects in installed materials and workmanship, beginning from the date of substantial completion of the installation.

C. Special Panel Finish Warranty: Submit Manufacturer’s limited warranty on the exterior paint finish for adhesion to the metal substrate and limited warranty on the exterior paint finish for chalk and fade.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Basis of Design Manufacturer: Metl-Span, a Division of the Cornerstone Building Brands family; Lewisville, Texas Tel: 972.221.6656; Email: info@metlspan.com; Web: metlspan.com.

B. Provide basis of design product [, or comparable product approved by Architect prior to bid].

2.2 PERFORMANCE REQUIREMENTS

A. General: Provide metal panel system meeting performance requirements as determined by application of specified tests by a qualified testing facility on manufacturer's standard assemblies.

B. Structural Performance: Provide metal panel assemblies capable of withstanding the effects of indicated loads and stresses within limits and under conditions indicated, as determined by ASTM E 72 or ASTM E 1592 applied in accordance with ICC AC 04, Section 4, Panel Load Test Option or Section 5, Panel Analysis Option:

1. Wind Loads: Determine loads based on applicable building code, wind speed, importance factor, exposure category, and internal pressure coefficient indicated on drawings.

   a. Wind Negative Pressure: Certify capacity of metal panels by testing of proposed assembly.

2. Deflection Limits: Withstand inward and outward wind-load design pressures in accordance with applicable building code with maximum deflection of 1/180 of the span with no evidence of failure.

C. Fire Performance Characteristics: Provide metal panel systems with the following fire-test characteristics determined by indicated test standard as applied by testing and inspection agency acceptable to authorities having jurisdiction.

1. Surface-Burning Characteristics: The insulating core shall have been tested per ASTM E 84. The core shall have:

   a. Flame spread index: 25 or less.
   b. Smoke developed index: 450 or less.

2. Room Test Performance: FM Global 4880: The panel assembly shall not support a self-propagating fire which reaches any limits of the 50’ (15.24m) high corner test structure as evidenced by flaming or material damage of the ceiling of the assembly.
3. Fire Propagation: The fire assembly shall meet the requirements of the standard for NFPA 285
4. Fire Growth: The fire assembly shall meet the requirements of the standard for NFPA 286
5. Potential Heat: Determined in accordance with NFPA 259

   a. Fire Endurance Tests of Building Construction and Materials: The composite panel shall have to be tested per CAN/ULS S101. Meets 15-minute stay in place requirement.
   b. Fire Test of Exterior Wall Assemblies. The composite panel shall have to be tested per CAN/ULS S134. Complies with the fire spread and heat flux limitations required by the National Building Code of Canada.
   c. Fire Growth of Insulated Building Panels in a Full-Scale Room Configuration: The composite panel shall have to be tested per CAN/ULS S138 Met the Criteria of the Standard.

6. IBC Chapter 26: Panel Performance under the above test methods, shall meet the requirements of IBC, Chapter on foam plastics.

D. Thermal Movements: Allow for thermal movements from variations in both ambient and internal temperatures. Accommodate movement of support structure caused by thermal expansion and contraction. Allow for deflection and design for thermal stresses caused by temperature differences from one side of the panel to the other.

2.3 INSULATED METAL WALL PANELS

A. Concealed Fastener, Insulated Metal Wall Panels with foam core: Structural metal panels consisting of exterior metal sheet and interior metal sheet with matching 4 by 1/8 inch (102 by 3 mm) o.c. profile. Factory foamed-in-place polyurethane core in thermally-separated profile, with tongue-and-groove panel edges, attached to supports using concealed fasteners.

1. Basis of Design: Metl-Span, CF Mesa
2. G-90 galvanized coated steel conforming to ASTM A 653 or AZ-50 aluminum-zinc alloy coated steel, conforming to ASTM A 792/A 792M, minimum grade 33, pre-painted by the coil-coating process per ASTM A 755/A 755M.

    a. Exterior Face Sheet: 24 gauge thickness, with smooth unembossed surface.

        1. Finish: Modified silicone-polyester two-coat system.
        2. Color: As selected by Architect from manufacturer's standard colors.

    b. Interior Face Sheet: 24 gauge thickness, with smooth unembossed surface Mesa or Light Mesa profile.

        1. Finish: Polyester two-coat system.
        2. Color: As selected by Architect from manufacturer's standard colors.

3. Panel Width: 36 inches (914 mm)]
4. Panel Thickness: as shown on drawings.
5. Insulating Core: Polyurethane with zero ozone depletion potential blowing agent

    a. Closed Cell Content: 90% or more as determined by ASTM D 6226
    b. Compressive Strength: As required to meet structural performance requirements and with a minimum of 22 psi as determined by ASTM D 1621
    c. Shear Strength: As required to meet structural performance requirements and with a minimum of 36 psi as determined by ASTM C 273
    d. Tensile Strength: As required to meet structural performance requirements and with a minimum of 41 psi ASTM D 1623
    e. Minimum Density: 2.0 pcf (32 kg/m3) as determined by ASTM D 1622

2.4 METAL WALL PANEL ACCESSORIES

A. General: Provide complete metal panel assemblies incorporating trim, copings, fasciae, gutters and downspouts, and miscellaneous flashings. Provide required fasteners, closure strips, and sealants as indicated in manufacturer's written instructions.

B. Flashing and Trim: Match material, thickness, and finish of metal panels.

C. Panel Clips: ASTM A 653/A 653M, G90 (Z180) hot-dip galvanized zinc coating, one-piece, configured for concealment in panel joints, and identical to clips utilized in tests demonstrating compliance with performance requirements.

D. Panel Fasteners: Self-drilling or Self-tapping screws and other acceptable fasteners recommended by metal panel manufacturer. Where exposed fasteners cannot be avoided, supply corrosion-resistant fasteners with heads matching color of metal panels by means of factory-applied coating, with weathertight resilient washers.

E. Joint Sealers:

1. Sealants: Provide Tape Mastic Sealants, Non-skinning sealants, and Urethane Sealants in accordance with manufacturers standards
2. Vertical Joint Gasket: Manufacturers standard EPDM gasket. Color: Black.

2.5 FABRICATION

A. General: Provide factory fabricated and finished metal panels, trim, and accessories meeting performance requirements, indicated profiles, and structural requirements.

B. Fabricate metal panel joints configured to accept sealant providing weathertight seal.

C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's written instructions, approved shop drawings, and project drawings.

2.6 FINISHES

A. Finishes, General: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer’s written instructions.

B. Exterior Face Sheet Coil-Coated Finish System

1. Silicone-Polyester Two-Coat System: 0.20 – 0.25 mil primer with 0.7 – 0.8 mil color coat.

    a. Basis of Design: Metl-Span, Silicone Polyester.

2. Fluoropolymer Two-Coat System: 0.2 – 0.3 mil primer with 0.7 - 0.8 mil 70 percent PVDF fluoropolymer color coat, [meeting solar reflectance index requirements].

    a. Basis of Design: Metl-Span, Fluoropolymer.

C. Interior Face Sheet Coil-Coated Finish System

1. Polyester Two-Coat System: 0.20 – 0.25 mil primer with 0.7 – 0.8 mil color coat

    a. Basis of Design: Metl-Span, Igloo White

2. Silicone-Polyester Two-Coat System: 0.20 – 0.25 mil primer with 0.7 – 0.8 mil color coat

    a. Basis of Design: Metl-Span, Silicone Polyester

3. Fluoropolymer Two-Coat System: 0.2-mil primer with 0.7 - 0.8 mil 70 percent PVDF fluoropolymer color coat

    a. Basis of Design: Metl-Span, Fluoropolymer

4. Vinyl Plastisol Two-Coat System: 0.2 mil primer with 4 mil high solids plastisol finished with PVC technology.

    a. Basis of Design: Metl-Span, Vinyl

5. 304 and 316 Stainless Steel: 2B 304 or 2B 316 Stainless Steel.

    a. Basis of Design: Metl-Span, Stainless Steel

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine metal panel system substrate with Installer present. Inspect for erection tolerances and other conditions that would adversely affect installation of metal panels.

1. Inspect framing that will support insulated metal panels to determine if support components are installed as indicated on approved shop drawings and are within tolerances acceptable to metal panel manufacturer and installer. Confirm presence of

acceptable framing members at recommended spacing to match installation requirements of metal panels.

2. Panel Support Tolerances: Confirm that metal panel supports are within tolerances acceptable to metal panel manufacturer but not greater than the following:

    a. 1/4 inch (6 mm) in 20 foot (6100 mm) in any direction.
    b. 3/8 inch (9 mm) over any single wall plane.
    c. Girt Spacing 8 feet (2438 mm) or more: 1/4 inch (6 mm) out only.
    d. Girt Spacing Less Than 8 feet (2438 mm): 1/8 inch (3 mm) out only.
    e. CF Architectural girt spacing less than 4 feet (1219 mm): 1/16 inch (1.5 mm) inch out only.

B. Correct out-of-tolerance work and other deficient conditions prior to proceeding with insulated metal panel installation.

3.2 METAL PANEL INSTALLATION

A. Concealed-Fastener Insulated Metal Panels with foam core: Install metal panel system in accordance with manufacturer's written instructions, approved shop drawings, and project drawings. Install metal panels in orientation, sizes, and locations indicated. Anchor panels and other components securely in place. Provide for thermal and structural movement.

B. Attach panels to metal framing using screws, fasteners, sealants, and adhesives recommended for application by metal panel manufacturer.

1. Fasten metal panels to supports with fasteners at each location indicated on approved shop drawings, at spacing and with fasteners recommended by manufacturer.
2. Cut panels in field where required using manufacturer's recommended methods.
3. Provide weatherproof jacks for pipe and conduit penetrating metal panels.
4. Dissimilar Materials: Where elements of metal panel system will come into contact with dissimilar materials, treat faces and edges in contact with dissimilar materials as recommended by metal panel manufacturer

C. Attach panel flashing trim pieces to supports using recommended fasteners and joint sealers

D. Joint Sealers: Install sealants where indicated and where required for weatherproof performance of metal panel assemblies

1. Seal panel base assembly, openings, panel head joints, and perimeter joints using sealants indicated in manufacturer's instructions
2. Seal wall panel joints; apply continuously without gaps in accordance with manufacturer's written instructions, approved shop drawings, and project drawings
3. Prepare joints and apply sealants per requirements of Division 07 Section.

3.3 ACCESSORY INSTALLATION

A. General: Install metal panel accessories with positive anchorage to building and weather tight mounting; provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel assembly, including trim, copings, flashings, sealants, closure strips, and similar items.
2. Comply with details of assemblies utilized to establish compliance with performance requirements and manufacturer's written installation instructions.
3. Set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently weather resistant.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage an independent testing and inspecting agency acceptable to Architect to perform field tests and inspections and to prepare test reports.

3.5 CLEANING AND PROTECTION

A. Remove temporary protective films immediately in accordance with metal panel manufacturer's instructions. Clean finished surfaces as recommended by metal panel manufacturer.

B. Replace damaged panels and accessories that cannot be repaired to the satisfaction of the Architect.

END OF SECTION

SECTION 075400
THERMOPLASTIC MEMBRANE ROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Adhered system with thermoplastic roofing membrane.

B. Insulation, flat and tapered.

C. Vapor retarder.

D. Deck sheathing.

E. Cover boards.

F. Flashings.

G. Roofing cant strips, stack boots, roofing expansion joints, and walkway pads.

H. Roof pavers systems.

1.02 REFERENCE STANDARDS

A. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation 2019.

B. ASTM C728 - Standard Specification for Perlite Thermal Insulation Board 2017a.

C. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing 2017.

D. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board 2021.

E. ASTM C1396/C1396M - Standard Specification for Gypsum Board 2017.

F. ASTM C1484 - Standard Specification for Vacuum Insulation Panels 2010 (Reapproved 2018).

G. ASTM D4434/D4434M - Standard Specification for Poly(Vinyl Chloride) Sheet Roofing 2021.

H. ASTM D6878/D6878M - Standard Specification for Thermoplastic Polyolefin Based Sheet Roofing 2019.

I. FM (AG) - FM Approval Guide current edition.

J. FM DS 1-28 - Wind Design 2016.

K. NRCA (RM) - The NRCA Roofing Manual 2019.

L. NRCA (WM) - The NRCA Waterproofing Manual 2005.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.
   1. Review preparation and installation procedures and coordinating and scheduling required with related work.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data indicating membrane materials, flashing materials, insulation, vapor retarder, surfacing, and fasteners.

C. Shop Drawings: Submit drawings that indicate joint or termination detail conditions, conditions of interface with other materials, and paver layout.

D. Warranty Documentation:
   1. Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
   2. Submit installer's certification that installation complies with warranty conditions for waterproof membrane.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original containers, dry and undamaged, with seals and labels intact.

B. Store materials in weather protected environment, clear of ground and moisture.

C. Ensure storage and staging of materials does not exceed static and dynamic load-bearing capacities of roof decking.

D. Protect foam insulation from direct exposure to sunlight.

1.06 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. System Warranty: Provide manufacturer's system warranty agreeing to repair or replace roofing that leaks or is damaged due to wind or other natural causes.
   1. Warranty Term: 20 years.
   2. For repair and replacement include costs of both material and labor in warranty.

PART 2 PRODUCTS

2.01 THERMOPLASTIC MEMBRANE ROOFING ELEMENTS

A. (07.5400.14) TPVC roof membrane 80 mil thickness, fully adhered.
   1. Thermoplastic Polyvinyl Chloride membrane

B. (07.5400.30) 5/8" GFR GWB deck sheathing

C. (07.5400.31) Vapor barrier

D. (07.5400.32) 3" Polyiso insulation, mechanically fastened first layer.

E. (07.5400.33) 3" Polyiso insulation, stagger joints from first layer, fully adhered, second layer.

F. (07.5400.34) Tapered Polyiso insulation, fully adhered.

G. (07.5400.35) 5/8" GFR GWB deck sheathing.

H. (07.5400.40) Conductive Grid System for Electronic Leak Detection (ELD)

2.02 MANUFACTURERS

A. Thermoplastic Polyvinyl Chloride (PVC) Membrane Roofing Materials:
   1. Carlisle Roofing Systems, Inc; Sure-Flex PVC KEE: www.carlisle-syntec.com/#sle.
   2. GAF; EverGuard PVC 50 mil: www.gaf.com/#sle.
   3. Sika Corporation Roofing; Sarnafil PVC: usa.sika.com/sarnafil/#sle.
   4. Sika Corporation Roofing; Decor Roof Systems: usa.sika.com/sarnafil/#sle.
   5. Versico Roofing Systems; VersiFleece PVC Polyester Reinforced Membrane: www.versico.com/#sle.
   6. Substitutions: See Section 016000 - Product Requirements.

B. Insulation:
   1. Carlisle SynTec; SecurShield Insulation: www.carlisle-syntec.com/#sle.
   2. Versico Roofing Systems; SecurShield Insulation: www.versico.com/#sle.
   3. Substitutions: See Section 016000 - Product Requirements.

2.03 ROOFING - UNBALLASTED APPLICATIONS

A. Thermoplastic Membrane Roofing: One ply membrane, fully adhered, over insulation.

B. Acceptable Insulation Types - Constant Thickness Application:
   1. Minimum 2 layers of polyisocyanurate, extruded polystyrene, or composite board.

C. Acceptable Insulation Types - Tapered Application:
   1. Tapered polyisocyanurate, perlite, or extruded polystyrene board.

2.04 MEMBRANE ROOFING AND ASSOCIATED MATERIALS

A. Membrane Roofing Materials:
   1. PVC: Polyvinyl chloride (PVC) complying with ASTM D4434/D4434M, Type II, sheet contains reinforcing fibers or reinforcing fabrics.
      a. Thickness: 80 mil, 0.080 inch (2 mm), minimum.

2. Sheet Width:
    a. Adhered Application: Limit width to 120 inches (3,048 mm), maximum, when ambient temperatures are less than 40 degrees F (4.4 degress C) for extended period of time during installation.
3. Solar Reflectance: 0.75, minimum, initial, and 0.65, minimum, 3-year, certified by Cool Roof Rating Council.
4. Thermal Emissivity: 0.80, minimum, initial, and 0.79, minimum, 3-year, certified by Cool Roof Rating Council.
5. Color: White.

B. Seaming Materials: As recommended by membrane manufacturer.

C. Vapor Retarder: Material approved by roof manufacturer complying with requirements of fire rating classification; compatible with roofing and insulation materials.
    1. Fire-retardant adhesive.

D. Flexible Flashing Material: Same material as membrane.

2.05 DECK SHEATHING

A. Deck Sheathing: Glass-mat faced gypsum panels complying with ASTM C1177/C1177M.
    1. Thickness: 5/8 inch (15.9 mm), Type X, fire-resistant.

2.06 COVER BOARDS

A. Cover Boards: Glass-mat faced gypsum panels complying with ASTM C1177/C1177M.
    1. Thickness: 5/8 inch (15.9 mm), Type X, fire-resistant.

2.07 INSULATION

A. Polyisocyanurate (ISO) Board Insulation: Rigid cellular foam, complying with ASTM C1289.
    1. Classifications:
        a. Type II:
            1) Class 1 - Faced with glass fiber reinforced cellulosic felt facers on both major surfaces of core foam.
            2) Compressive Strength: Classes 1-2-3, Grade 1, 16 psi (110 kPa), minimum.
            3) Thermal Resistance, R-value (RSI-value): At 1-1/2 inches (38 mm) thick; Class 1, Grades 1-2-3, 8.4 (1.48), minimum, at 75 degrees F (24 degrees C).

2.08 ACCESSORIES

A. Conductive Grid System for Electronic Leak Detection (ELD): Enables ELD of conventional roofing assemblies by providing leak detective tape strips within roofing system.
    1. Moisture Detection Tape: Tape strips with parallel flat copper conductors that detect surface moisture in area between conductors.
    2. Monitoring System: Provide control units, wiring, and accessories as required for continuous monitoring of moisture detection tape.
        a. Upon detection of leak, activate alarm and send report to off-site monitoring service.
    3. Products:
        a. Detec Systems: www.detecsystems.com/#sle.
        b. Substitutions: See Section 016000 - Product Requirements.

B. Insulation Fasteners: Appropriate for purpose intended and approved by roofing manufacturer.

C. Membrane Adhesive: As recommended by membrane manufacturer.

D. Insulation Adhesive: As recommended by insulation manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and site conditions are ready to receive work.

B. Verify deck is supported and secure.

C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.

D. Verify deck surfaces are dry and free of snow or ice.

E. Verify that roof openings, curbs, and penetrations through roof are solidly set, and cant strips are in place.

3.02 PREPARATION - METAL DECK

A. Install deck sheathing on metal deck:
   1. Lay with long side at right angle to flutes; stagger end joints; provide support at ends.
   2. Cut sheathing cleanly and accurately at roof breaks and protrusions to provide smooth surface.
   3. Mechanically fasten sheathing to roof deck, in accordance with Factory Mutual recommendations and roofing manufacturer's instructions.
      a. Over entire roof area, fasten sheathing using six fasteners with washers per sheathing board.
      b. At roof perimeter to a distance of 4 ft (1.2 m) in from edges, fasten sheathing using six fasteners with washers per board.

3.03 INSTALLATION, GENERAL

A. Perform work in accordance with manufacturer's instructions, NRCA (RM), and NRCA (WM) applicable requirements.

B. Do not apply roofing membrane during cold or wet weather conditions.

C. Do not apply roofing membrane when ambient temperature is outside the temperature range recommended by manufacturer.

D. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.

E. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.

3.04 INSTALLATION - VAPOR RETARDER AND INSULATION, UNDER MEMBRANE

A. Install vapor retarder to deck surface with adhesive in accordance with manufacturer's instructions.
   1. Extend vapor retarder under cant strips and blocking to deck edge.
   2. Install flexible flashing from vapor retarder to air seal material of wall construction, lap and seal to provide continuity of the air barrier plane.

B. Ensure vapor retarder is clean and dry, continuous, and ready for application of insulation.

C. Attachment of Insulation:
   1. Embed first layer of insulation in full bed of adhesive in accordance with roofing and insulation manufacturers' instructions.
   2. Mechanically fasten subsequent layer of insulation to deck in accordance with roofing manufacturer's instructions and FM (AG) Factory Mutual requirements.

D. Cover Boards: Mechanically fasten cover boards in accordance with roofing manufacturer's instructions and FM (AG) Factory Mutual requirements.

E. Lay subsequent layers of insulation with joints staggered minimum 6 inches (152 mm) from joints of preceding layer.

F. Place tapered insulation to the required slope pattern in accordance with manufacturer's instructions.

G. On metal deck, place boards parallel to flutes with insulation board edges bearing on deck flutes.

H. Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.

I. Do not install more insulation than can be covered with membrane in same day.

3.05 INSTALLATION - MEMBRANE

A. Roll out membrane, free from wrinkles or tears. Place sheet into place without stretching.

B. Shingle joints on sloped substrate in direction of drainage.

C. Fully Adhered Application: Apply adhesive to substrate at rate per manufacturer's instructions. Fully embed membrane in adhesive except in areas directly over or within 3 inches (76 mm) of expansion joints. Fully adhere one roll before proceeding to adjacent rolls.

D. Overlap edges and ends and seal seams by contact adhesive, minimum 3 inches (76 mm). Seal permanently waterproof. Apply uniform bead of sealant to joint edge.

E. At intersections with vertical surfaces:
   1. Extend membrane over cant strips and up a minimum of 4 inches (102 mm) onto vertical surfaces.
   2. Fully adhere flexible flashing over membrane and up to nailing strips.

F. Around roof penetrations, seal flanges and flashings with flexible flashing.

G. Coordinate installation of roof drains and sumps and related flashings.

3.06 FIELD QUALITY CONTROL

A. Owner will provide testing services in accordance with Section 014000 - Quality Requirements. Contractor to provide temporary construction and materials for testing.

B. Provide daily on-site attendance of roofing and insulation manufacturer's representative during installation of this work.

3.07 CLEANING

A. See Section 017419 - Construction Waste Management and Disposal for additional requirements.

B. Remove bituminous markings from finished surfaces.

C. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and comply with their documented instructions.

D. Repair or replace defaced or damaged finishes caused by work of this section.

3.08 PROTECTION

A. Protect installed roofing and flashings from construction operations.

B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

END OF SECTION

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SECTION 077123
MANUFACTURED GUTTERS AND DOWNSPOUTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pre-finished aluminum gutters and downspouts.

1.02 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum 2014 (2015 Errata).

B. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2017a.

C. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2017a.

D. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2017a.

E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.

F. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.

G. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.

H. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.

I. SMACNA (ASMM) - Architectural Sheet Metal Manual 2012.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Comply with SMACNA (ASMM) for sizing components for rainfall intensity determined by a storm occurrence of 1 in 5 years.

B. Comply with applicable code for size and method of rain water discharge.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on prefabricated components.

C. Shop Drawings: Indicate locations, configurations, jointing methods, fastening methods, locations, and installation details.

D. Samples: Submit two samples, 6 inch (152 mm) long illustrating component design, finish, color, and configuration.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope to drain.

B. Prevent contact with materials that could cause discoloration, staining, or damage.

PART 2 PRODUCTS

2.01 MANUFACTURED GUTTER / DOWNSPOUT ELEMENTS

A. (07.7123.02) 5" X 5" rectangular downspout

2.02 MANUFACTURERS

A. Gutters and Downspouts:
   1. SAF Perimeter Systems, a division of Southern Aluminum Finishing Company, Inc : www.saf.com/persys/#sle.
   2. Substitutions: See Section 016000 - Product Requirements.

2.03 MATERIALS

A. Pre-Finished Aluminum Sheet: ASTM B209 (ASTM B209M); [.040] inch ([____] mm)thick.
   1. Finish: Plain, shop pre-coated with modified silicone coating.
   2. Color: As indicated.

2.04 COMPONENTS

A. Downspouts: SMACNA Rectangular profile.

B. Anchors and Supports: Profiled to suit gutters and downspouts.
   1. Anchoring Devices: In accordance with CDA requirements.
   2. Downspout Supports: Brackets.

C. Fasteners: Stainless steel .

2.05 FABRICATION

A. Form gutters and downspouts of profiles and size indicated.

B. Fabricate with required connection pieces.

C. Form sections square, true, and accurate in size, in maximum possible lengths, free of distortion or defects detrimental to appearance or performance. Allow for expansion at joints.

D. Hem exposed edges of metal.

E. Fabricate gutter and downspout accessories; seal watertight.

F. FINISHES
   1. Class I Color Anodized Finish: AAMA 611 AA-M12C22A42; integrally colored anodic coating not less than 0.7 mils (0.018 mm) thick.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

3.02 INSTALLATION

A. Install gutters, downspouts, and accessories in accordance with manufacturer's instructions.

B. Slope gutters per manufacturer's recommendations and AHJ.

END OF SECTION

SECTION 077200
ROOF ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Roof hatches.

B. Snow guards.

1.02 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.

B. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process 2021a.

1.03 SUBMITTALS

A. See Division 1 for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used.
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
   4. Maintenance requirements.

C. Shop Drawings: Submit detailed layout developed for this project and provide dimensioned location and number for each type of roof accessory.
   1. Snow Guards: Submit design calculations for loadings and spacings based on manufacturer testing.
   2. Submit shop drawings sealed and signed by a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

D. Warranty Documentation:
   1. Submit manufacturer warranty.
   2. Ensure that forms have been completed in Owner's name and registered with manufacturer.
   3. Submit documentation that roof accessories are acceptable to roofing manufacturer, and do not limit the roofing warranty.

1.04 DELIVERY, STORAGE, AND HANDLING

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

B. Store products under cover and elevated above grade.

1.05 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five-year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 ROOF ACCESSORY ELEMENTS

A. (07.7200.00) Bilco roof hatch 48" x 48"

B. (07.7200.10): Bilco hatch safety rail

C. (07.7200.11) Bilco ladder up safety post

D. (07.7200.40) Snow fence for standing seam roof, 2 pipe type

2.02 ROOF HATCHES AND VENTS

A. Roof Hatch Manufacturers:
   1. Bilco Company: www.bilco.com/#sle.
   2. Substitutions: See Section 016000 - Product Requirements.

B. Frames and Curbs: One-piece curb and frame with integral cap flashing to receive roof flashings; extended bottom flange to suit mounting.

1. Insulation: Manufacturer's standard; 1 inch (25 mm) rigid glass fiber, located on outside face of curb.

C. Hardware: Steel, zinc coated and chromate sealed, unless otherwise indicated or required by manufacturer.
   1. Lifting Mechanisms: Compression or torsion spring operator with shock absorbers that automatically opens upon release of latch; capable of lifting covers despite 10 psf (475 kPa) load.
   2. Hinges: Heavy duty pintle type.
   3. Hold open arm with vinyl-coated handle for manual release.
   4. Latch: Upon closing, engage latch automatically and reset manual release.
   5. Manual Release: Pull handle on interior.
   6. Locking: Padlock hasp on interior.

2.03 ROOF HATCH (4' X 4')

A. (07.7200.00) Bilco roof hatch 48" x 48"

B. Basis-of-Design Manufacturer: Type: Single Leaf, Equipment Roof Hatch by The BILCO Company, P.O. Box 1203, New Haven, CT 06505, 1-800-366-6530, Fax: 1-203-535-1582, Web: www.bilco.com.

C. Furnish and install where indicated on plans metal roof hatch Type 'F' Equipment Access, size width: 48" (914mm) x length: 48" (914mm). Length denotes hinge side. The roof hatch shall be single leaf. The roof hatch shall be pre-assembled from the manufacturer.

D. Performance characteristics:
   1. Cover shall be reinforced to support a minimum live load of 40 psf (195kg/m2) with a maximum deflection of 1/150th of the span or 20 psf (97 kg/m2) wind uplift.
   2. Operation of the cover shall be smooth and easy with controlled operation throughout the entire arc of opening and closing.
   3. Operation of the cover shall not be affected by temperature.
   4. Entire hatch shall be weather tight with fully welded corner joints on cover and curb.

E. Cover: Shall be 11 gauge (2.3mm) aluminum with a 3" (76mm) beaded flange with formed reinforcing members. Cover shall have a heavy extruded EPDM rubber gasket that is bonded to the cover interior to assure a continuous seal when compressed to the top surface of the curb.

F. Cover insulation: Shall be fiberglass of 1” (25mm) thickness, fully covered and protected by a metal liner 18 gauge (1mm) aluminum.

G. Curb: Shall be 12” (305mm) in height and of 11 gauge (2.3mm) aluminum. The curb shall be formed with a 3-1/2” (89mm) flange with 7/16” (11.1mm) holes provided for securing to the roof deck. The curb shall be equipped with an integral metal capflashing of the same gauge and material as the curb, fully welded at the corners, that features the Bil-Clip® flashing system, including stamped tabs, 6” (153mm) on center, to be bent inward to hold single ply roofing membrane securely in place.

H. Curb insulation: Shall be rigid, high-density fiberboard of 1” (25mm) thickness on outside of curb.

I. Lifting mechanisms: Manufacturer shall provide compression spring operators enclosed in telescopic tubes to provide, smooth, easy, and controlled cover operation throughout the entire arc of opening and closing. The upper tube shall be the outer tube to prevent accumulation of moisture, grit, and debris inside the lower tube assembly. The lower tube shall interlock with a flanged support shoe [for aluminum construction: welded to the curb assembly; for steel construction: through bolted to the curb assembly].

J. Hardware
   1. Heavy pintle hinges shall be provided
   2. Cover shall be equipped with a spring latch with interior and exterior turn handles
   3. Roof hatch shall be equipped with interior and exterior padlock hasps.
   4. The latch strike shall be a stamped component bolted to the curb assembly.
   5. Cover shall automatically lock in the open position with a rigid hold open arm equipped with a 1” (25mm) diameter red vinyl grip handle to permit easy release for closing.

6. Compression spring tubes shall be an anti-corrosive composite material and all other hardware shall be zinc plated and chromate sealed.
7. Cover hardware shall be bolted into heavy gauge channel reinforcing welded to the underside of the cover and concealed within the insulation space.

K. Finishes: Factory finish shall be alkyd based red oxide primed steel.

2.04 ROOF HATCH ACCESSORIES

A. (07.7200.10): Bilco hatch safety rail

B. Basis-of-Design Manufacturer: Type: Bil-Guard 2.0 Safety Railing System by The BILCO Company, P.O. Box 1203, New Haven, CT 06505, 1-800-366-6530, Fax: 1-203-535-1582, Web: www.bilco.com.
   1. Posts and rails are schedule 40 pipe in 6061 T6 aluminum alloy. Curb mounting brackets and teardrop brackets are 6063 T5 aluminum extrusion. Locking mechanism is cast aluminum and spring hinges and all fasteners are type 316 stainless steel. Hatch rail system satisfies the requirements of OSHA 29 CFR 1910.23 and meets OSHA strength requirements. Finish shall be safety yellow* powder coat paint finish. Manufacturer shall provide a 5-year warranty against defects in material and workmanship.
   2. Standard Features
      a. Aluminum rail construction with powder coat paint finish
      b. Applicable requirements: OSHA 29 CFR 1910.23
      c. Standard self-closing and latching gate feature ensuring that the opening is protected at all times
      d. Non-penetrating attachment attaches directly to roof hatch capflashing
      e. High visibility safety yellow color
      f. Corrosion resistant construction carrying a 5-year warranty

C. (07.7200.11) Bilco ladder up safety post

D. Basis-of-Design Manufacturer: Type: LadderUp Safety Post by The BILCO Company, P.O. Box 1203, New Haven, CT 06505, 1-800-366-6530, Fax: 1-203-535-1582, Web: www.bilco.com.
   1. Install on fixed ladder(s) below hatch cover(s), Ladder safety post Model LU-1 as manufactured by The Bilco Company. Device shall be Steel, yellow powder coat. It shall be designed with a telescoping tubular section that locks automatically when fully extended. Upward and downward movement shall be controlled by a stainless steel spring balancing mechanism. Unit shall be completely assembled with fasteners for securing to the ladder rungs in accordance with the manufacturer' s instructions.
      a. Adjustable mounting hardware accommodates virtually any ladder rung size or spacing.
      b. Telescoping design is spring balanced for ease of operation.
      c. Automatically locks in the fully raised position to provide the user with a firm and steady hand-hold for safer egress
      d. Handy release lever allows the post to be easily lowered to its retracted position.
      e. Available in four levels of corrosion resistance to provide many years of trouble free, dependable service

2.05 SNOW GUARDS

A. Fence Type Snow Guard: Continuous snow guard; manufacturer's standard pipe, bar, channel, or solid rod, set in brackets or posts, with optional plates and metal trim to match roof.

B. (07.7253.41) Snojax 2 bar snow rail for standing seam roof
   1. IceBlox, Inc., d.b.a. Snoblox-Snojax 1405 Brandton Road, Mechanicsburg, PA 17055
      a. Phone: (800) 766-5291; (717) 737-4398; Fax: (800) 634-7906, (717) 697-6141; Online: www.snoblox.com support@snojax.com
   2. Materials
      a. 2 bar snow bar for standing seam roofs.
      b. Injection molded prime virgin grade polycarbonate polymer material construction containing a UV stabilizer.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions, in manner that maintains roofing system weather-tight integrity.

3.02 CLEANING

A. Clean installed work to like-new condition.

3.03 PROTECTION

A. Protect installed products until completion of project.

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

END OF SECTION

SECTION 078400
FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Firestopping systems.

B. Firestopping of joints and penetrations in fire-resistance-rated and smoke-resistant assemblies, whether indicated on drawings or not, and other openings indicated.

1.02 REFERENCE STANDARDS

A. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems 2013a (Reapproved 2017).

B. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems 2015 (Reapproved 2019).

C. ASTM E2307 - Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-story Test Apparatus 2020.

D. ASTM E2837 - Standard Test Method for Determining the Fire Resistance of Continuity Head-of-Wall Joint Systems Installed Between Rated Wall Assemblies and Nonrated Horizontal Assemblies 2013 (Reapproved 2017).

E. ITS (DIR) - Directory of Listed Products current edition.

F. FM (AG) - FM Approval Guide current edition.

G. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems Current Edition, Including All Revisions.

H. UL (DIR) - Online Certifications Directory Current Edition.

I. UL (FRD) - Fire Resistance Directory Current Edition.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on product characteristics, performance ratings, and limitations.

C. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.

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

E. Manufacturer's qualification statement.

F. Installer's qualification statement.

1.04 QUALITY ASSURANCE

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

B. Installer Qualifications: Company specializing in performing the work of this section and:
   1. Trained by manufacturer.

1.05 FIELD CONDITIONS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.

PART 2 PRODUCTS

2.01 MATERIALS

A. Firestopping Materials: Any materials meeting requirements.

B. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.

2.02 FIRESTOPPING ASSEMBLY REQUIREMENTS

A. Perimeter Fire Containment Firestopping: Use system that has been tested according to ASTM E2307 to have fire resistance F Rating equal to required fire rating of floor assembly.

1. Movement: Provide systems that have been tested to show movement capability as indicated.
2. Temperature Rise: Provide systems that have been tested to show T Rating as indicated.
3. Air Leakage: Provide systems that have been tested to show L Rating as indicated.
4. Where floor assembly is not required to have a fire rating, provide systems that have been tested to show L Rating as indicated.

B. Head-of-Wall (HW) Joint System Firestopping at Joints Between Fire-Rated Wall Assemblies and Non-Rated Horizontal Assemblies: Use system that has been tested according to ASTM E2837 to have fire resistance F Rating equal to required fire rating of wall assembly.
   1. Movement: Provide systems that have been tested to show movement capability as indicated.

C. Floor-to-Floor (FF), Floor-to-Wall (FW), Head-of-Wall (HW), and Wall-to-Wall (WW) Joints, Except Perimeter, Where Both Are Fire-Rated: Use system that has been tested according to ASTM E1966 or UL 2079 to have fire resistance F Rating equal to required fire rating of the assembly in which the joint occurs.
   1. Movement: Provide systems that have been tested to show movement capability as indicated.
   2. Air Leakage: Provide systems that have been tested to show L Rating as indicated.
   3. Watertightness: Provide systems that have been tested to show W Rating as indicated.
   4. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.

D. Through Penetration Firestopping: Use system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.
   1. Temperature Rise: Provide systems that have been tested to show T Rating as indicated.
   2. Air Leakage: Provide systems that have been tested to show L Rating as indicated.
   3. Watertightness: Provide systems that have been tested to show W Rating as indicated.
   4. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.

2.03 FIRESTOPPING FOR PERIMETER CONTAINMENT

A. Perimeter Joint Systems That Have Not Been Tested For Movement Capabilities (Static-S):
   1. 2 Hour Construction: UL System CW-S-0002; Specified Technologies Inc. AS200 Elastomeric Spray.
   2. 2 Hour Construction: UL System CW-S-0002; Specified Technologies Inc. Fast Tack Firestop Spray.
   3. 2 Hour Construction: UL System CW-S-0003; Specified Technologies Inc. Fast Tack Firestop Spray.
   4. 2 Hour Construction: UL System CW-S-0007; Specified Technologies Inc. SpeedFlex TTG Track Top Gasket.

B. Perimeter Joint Systems That Have Movement Capabilities (Dynamic-D):
   1. 3 Hour Construction: UL System CW-D-2005; Specified Technologies Inc. Fast Tack Firestop Spray.
   2. 2 Hour Construction: UL System CW-D-1004; Specified Technologies Inc. AS200 Elastomeric Spray.
   3. 2 Hour Construction: UL System CW-D-1004; Specified Technologies Inc. Fast Tack Firestop Spray.
   4. 2 Hour Construction: UL System CW-D-1011; Specified Technologies Inc. Fast Tack Firestop Spray.
   5. 2 Hour Construction: UL System CW-D-2042; Specified Technologies Inc. Fast Tack Firestop Spray.

2.04 FIRESTOPPING FOR FLOOR-TO-FLOOR, FLOOR-TO-WALL, HEAD-OF-WALL, AND WALL-TO-WALL JOINTS

A. Concrete and Concrete Masonry Walls and Floors:
   1. Floor-to-Floor Joints:
      a. 07.8400.01: 2 Hour Construction, floor to floor- concrete: UL System FF-D-1013; Hilti CFS-SP WB Firestop Joint Spray and CP 672.

2.05 HEAD-OF-WALL JOINTS AT CONCRETE/CONCRETE MASONRY WALL TO CONCRETE OVER METAL DECK FLOOR:

A. 07.8400.02: 2 Hour Construction, top of wall concrete/masonry over metal deck: UL System HW-D-0181; Hilti CFS-SP WB Firestop Joint Spray and CP 672.

B. 07.8400.03: 2 Hour Construction, top of wall concrete/masonry over metal deck: UL System HW-D-1037; Hilti CFS-SP WB Firestop Joint Spray and CP 672.

2.06 HEAD-OF-WALL JOINTS AT CONCRETE/CONCRETE MASONRY WALL TO CONCRETE FLOOR:

A. 07.8400.04: 3 Hour Construction top of wall at concrete/masonry to concrete floor: UL System HW-D-1058; Hilti CFS-SP WB Firestop Joint Spray and CP 672.

B. 07.8400.05: 2 Hour Construction top of wall at concrete/masonry to concrete floor: UL System HW-D-0268; Hilti CP 606 Flexible Firestop Sealant.

2.07 CONCRETE/CONCRETE MASONRY WALL-TO-WALL JOINT SYSTEMS THAT HAVE MOVEMENT CAPABILITIES (DYNAMIC-D):

A. 07.8400.06: 2 Hour Construction concrete/masonry joints that have movement capabilities: UL System WW-D-0017; Hilti CFS-SP WB Firestop Joint Spray and CP 672.

B. 07.8400.07: 2 Hour Construction concrete/masonry joints that have movement capabilities: UL System WW-D-0032; Hilti CP 606 Flexible Firestop Sealant.

2.08 GYPSUM BOARD WALLS:

A. Wall-to-Wall Joints That Have Not Been Tested For Movement Capabilities (Static-S):
   1. 07.8400.08: 2 Hour Construction wall to wall joints, (static): UL System WW-S-0063; Specified Technologies Inc. SpeedFlex TTG Track Top Gasket.
   2. 07.8400.09 1 Hour Construction wall to wall joints, (static): UL System WW-S-0063; Specified Technologies Inc. SpeedFlex TTG Track Top Gasket.

2.09 WALL-TO-WALL JOINTS THAT HAVE MOVEMENT CAPABILITIES (DYNAMIC-D):

A. 2 Hour Construction: UL System WW-D-0180; Specified Technologies Inc. SpeedFlex TTG Track Top Gasket.
   1. 07.8400.10 2 Hour Construction wall to wall joints (Dynamic): UL System WW-D-0067; Hilti CP 606 Flexible Firestop Sealant.
   2. 07.8400.11 1 Hour Construction wall to wall joints (Dynamic): UL System WW-D-0067; Hilti CP 606 Flexible Firestop Sealant.

2.10 HEAD-OF-WALL JOINTS AT UNDERSIDE OF STEEL BEAM AND CONCRETE OVER METAL DECK FLOOR WITH SPRAYED ON FIREPROOFING:

A. 2 Hour Construction: UL System HW-D-0252; Specified Technologies Inc. AS200 Elastomeric Spray.
   1. 07.8400.12 2 Hour Construction, top of wall joints at underside of steel beam and concrete over metal deck floor with sprayed on fireproofing: UL System HW-D-0259; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
   2. 07.8400.13: 1 Hour Construction top of wall joints at underside of steel beam and concrete over metal deck floor with sprayed on fireproofing: UL System HW-D-0259; Hilti CFS-SP WB Firestop Joint Spray and CP 672.

2.11 HEAD-OF-WALL JOINTS AT UNDERSIDE OF FLAT CONCRETE:

A. 07.8400.14: 2 Hour Construction, top of wall joints at underside of flat concrete: UL System HW-D-1068; Hilti CFS-SP WB Firestop Joint Spray and CP 672.

B. 07.8400.15: 2 Hour Construction, top of wall joints at underside of flat concrete: UL System HW-D-0757; Hilti CFS-TTS Top Track Seal.

C. 07.8400.16: 1 Hour Construction, top of wall joints at underside of flat concrete: UL System HW-D-1068; Hilti CFS-SP WB Firestop Joint Spray and CP 672.

D. 07.8400.17: 1 Hour Construction, top of wall joints at underside of flat concrete: UL System HW-D-0757; Hilti CFS-TTS Top Track Seal.

E. 1 Hour Construction: UL System HW-D-0016; Tremco, TREMstop Acrylic Firestop Sealant.

F. Head-of-Wall Joints at Concrete Over Metal Deck:
   1. 2 Hour Construction: UL System HW-D-0034; Specified Technologies Inc. ES Elastomeric Firestop Sealant.
   2. 2 Hour Construction: UL System HW-D-0043; Specified Technologies Inc. AS200 Elastomeric Spray.
   3. 2 Hour Construction: UL System HW-D-0099; Specified Technologies Inc. SpeedFlex Joint Profile System.
   4. 2 Hour Construction: UL System HW-D-0363; Specified Technologies Inc. SpeedFlex Joint Profile System.

2.12 HEAD-OF-WALL JOINTS AT CONCRETE OVER METAL DECK, WALL PARALLEL TO RIBS:

A. 07.8400.18: 2 Hour Construction, top of wall joints at concrete over metal deck, wall parallel to ribs: UL System HW-D-0049; Hilti CFS-SP WB Firestop Joint Spray and CP 672.

B. 07.8400.19: 2 Hour Construction, top of wall joints at concrete over metal deck, wall parallel to rib: UL System HW-D-0184; Hilti CP 606 Flexible Firestop Sealant.

C. 07.8400.20: 1 Hour Construction, top of wall joints at concrete over metal deck, wall parallel to rib: UL System HW-D-0049; Hilti CFS-SP WB Firestop Joint Spray and CP 672.

D. 07.8400.21: 1 Hour Construction, top of wall joints at concrete over metal deck, wall parallel to rib: UL System HW-D-0184; Hilti CP 606 Flexible Firestop Sealant.

2.13 HEAD-OF-WALL JOINTS AT CONCRETE OVER METAL DECK, WALL PERPENDICULAR TO RIBS, CUT TO FIT RIBS:

A. 07.8400.22: 2 Hour Construction, top of wall joints at concrete over metal deck, wall perpendicular to ribs, cut to fit ribs: UL System HW-D-0045; Hilti CP 606 Flexible Firestop Sealant.

B. 07.8400.23: 1 Hour Construction, top of wall joints at concrete over metal deck, wall perpendicular to ribs, cut to fit ribs: UL System HW-D-0045; Hilti CP 606 Flexible Firestop Sealant.

2.14 HEAD-OF-WALL JOINTS AT CONCRETE OVER METAL DECK, WALL PERPENDICULAR TO RIBS, NOT CUT TO FIT:

A. 07.8400.24: 2 Hour Construction, top of wall joints at concrete over metal deck, wall perpendicular to ribs, not cut to fit ribs: UL System HW-D-0042; Hilti CFS-SP WB Firestop Joint Spray and CP 672.

B. 07.8400.25: 2 Hour Construction, top of wall joints at concrete over metal deck, wall perpendicular to ribs, not cut to fit ribs: UL System HW-D-0045; Hilti CP 606 Flexible Firestop Sealant.

C. 07.8400.26: 1 Hour Construction, top of wall joints at concrete over metal deck, wall perpendicular to ribs, not cut to fit ribs: UL System HW-D-0042; Hilti CFS-SP WB Firestop Joint Spray and CP 672.

D. 07.8400.27: 1 Hour Construction, top of wall joints at concrete over metal deck, wall perpendicular to ribs, not cut to fit ribs: UL System HW-D-0045; Hilti CP 606 Flexible Firestop Sealant.

2.15 FIRESTOPPING PENETRATIONS THROUGH CONCRETE AND CONCRETE MASONRY CONSTRUCTION

2.16 BLANK OPENINGS IN FLOORS OR WALLS:

A. 07.8400.28: 3 Hour Construction, blank penetrations through concrete / masonry in floors or walls: UL System C-AJ-0061; Specified Technologies Inc. SSB Intumescent Firestop pillows.

B. 07.8400.29: 2 Hour Construction, blank penetrations through concrete / masonry in floors or walls: UL System C-AJ-0090; Hilti FS-ONE MAX Intumescent Firestop Sealant.

2.17 PENETRATIONS THROUGH FLOORS OR WALLS BY:

A. Multiple Penetrations in Large Openings:
   1. 07.8400.30: 3 Hour Construction, penetrations through concrete/masonry walls or floors by multiple penetrations in large openings: UL System C-AJ-8099; Hilti FS-ONE MAX Intumescent Firestop Sealant.
   2. 07.8400.31: 3 Hour Construction, penetrations through concrete/masonry walls or floors by multiple penetrations in large openings: UL System C-AJ-8110; Hilti CFS-BL Firestop Block.
   3. 07.8400.32: 2 Hour Construction, penetrations through concrete/masonry walls or floors by multiple penetrations in large openings: UL System C-AJ-8143; Hilti FS-ONE MAX Intumescent Firestop Sealant.

B. Bathtub Drains:
   1. 07.8400.33: Up to 3 Hour Construction, penetrations through concrete/masonry walls or floors by bathtub drains: UL System F-A-1037, F-A-1038, F-A-2094, or F-A-2095; Hilti CP 681 Tub Box Kit.

C. Uninsulated Metallic Pipe, Conduit, and Tubing:
   1. 07.8400.34: 3 Hour Construction, penetrations through concrete/masonry walls or floors by uninsulated metallic pipe, conduit and tubing: UL System C-AJ-1184; Hilti FS-ONE MAX Intumescent Firestop Sealant.
   2. 07.8400.35: 3 Hour Construction, penetrations through concrete/masonry walls or floors by uninsulated metallic pipe, conduit and tubing: UL System C-AJ-1226; Hilti FS-ONE MAX Intumescent Firestop Sealant.
   3. 07.8400.36: 3 Hour Construction, penetrations through concrete/masonry walls or floors by uninsulated metallic pipe, conduit and tubing: UL System C-AJ-1421; Hilti FS-ONE MAX Intumescent Firestop Sealant or CP 604 Self-Leveling Firestop Sealant.
   4. 07.8400.37: 3 Hour Construction, penetrations through concrete/masonry walls or floors by uninsulated metallic pipe, conduit and tubing: UL System C-AJ-1425; Hilti CFS-S SIL GG Firestop Silicone Sealant Gun-Grade.
   5. 207.8400.38: 2 Hour Construction, penetrations through concrete/masonry walls or floors by uninsulated metallic pipe, conduit and tubing: UL System C-AJ-1226; Hilti FS-ONE MAX Intumescent Firestop Sealant.
   6. 07.8400.39: 2 Hour Construction, penetrations through concrete/masonry walls or floors by uninsulated metallic pipe, conduit and tubing: UL System C-AJ-1425; Hilti CFS-S SIL GG Firestop Silicone Sealant Gun-Grade.

D. Uninsulated Non-Metallic Pipe, Conduit, and Tubing:
   1. 07.8400.40: 3 Hour Construction, penetrations through concrete/masonry walls or floors by uninsulated non-metallic pipe, conduit and tubing: UL System C-AJ-2109; Hilti CP 643N/644 Firestop Collar.
   2. 07.8400.41: 3 Hour Construction, penetrations through concrete/masonry walls or floors by uninsulated non-metallic pipe, conduit and tubing: UL System C-AJ-2220; Hilti FS-ONE MAX Intumescent Firestop Sealant.
   3. 07.8400.42: 3 Hour Construction, penetrations through concrete/masonry walls or floors by uninsulated non-metallic pipe, conduit and tubing: UL System C-AJ-2342; Hilti CP-E/S Firestop Wrap Strip.
   4. 07.8400.43: 2 Hour Construction, penetrations through concrete/masonry walls or floors by uninsulated non-metallic pipe, conduit and tubing: UL System C-AJ-2167; Hilti FS-ONE MAX Intumescent Firestop Sealant.
   5. 07.8400.44: 2 Hour Construction, penetrations through concrete/masonry walls or floors by uninsulated non-metallic pipe, conduit and tubing: UL System C-AJ-2109; Hilti CP 643N/644 Firestop Collar.
   6. 07.8400.45: 2 Hour Construction, penetrations through concrete/masonry walls or floors by uninsulated non-metallic pipe, conduit and tubing: UL System C-BJ-2021; Hilti CP 643N Firestop Collar.

E. Electrical Cables Not In Conduit:

1. 07.8400.46: 3 Hour Construction, penetrations through concrete/masonry walls or floors by electrical cables not in conduit: UL System C-AJ-3095; Hilti FS-ONE MAX Intumescent Firestop Sealant.
2. 07.8400.47: 3 Hour Construction, penetrations through concrete/masonry walls or floors by electrical cables not in conduit: UL System C-AJ-3208; Hilti CP 618 Firestop Putty Stick.
3. 07.8400.48: 2 Hour Construction, penetrations through concrete/masonry walls or floors by electrical cables not in conduit: UL System C-AJ-3216; Hilti CFS-PL Firestop Plug.
4. 07.8400.49: 2 Hour Construction, penetrations through concrete/masonry walls or floors by electrical cables not in conduit: UL System W-J-3198; Hilti CFS-SL RK Retrofit Sleeve Kit for existing cables.
5. 07.8400.50: 2 Hour Construction, penetrations through concrete/masonry walls or floors by electrical cables not in conduit: UL System W-J-3199; Hilti CFS-SL SK Firestop Sleeve Kit.

F. Cable Trays with Electrical Cables:
1. 07.8400.51: 3 Hour Construction, penetrations through concrete/masonry walls or floors by cable trays with electrical cables: UL System C-AJ-4093; Hilti CFS-BL Firestop Block.
2. 07.8400.52: 2 Hour Construction, penetrations through concrete/masonry walls or floors by cable trays with electrical cables: UL System C-AJ-4094; Hilti CFS-BL Firestop Block.

G. Electrical Busways:
1. 07.8400.53: 3 Hour Construction, penetrations through concrete/masonry walls or floors by electrical busways: UL System C-AJ-6017; Hilti FS-ONE MAX Intumescent Firestop Sealant.

H. Insulated Pipes:
1. 07.8400.54: 3 Hour Construction, penetrations through concrete/masonry walls or floors by insulated pipes: UL System C-AJ-5090; Hilti FS-ONE MAX Intumescent Firestop Sealant.
2. 07.8400.55: 2 Hour Construction, penetrations through concrete/masonry walls or floors by insulated pipes: UL System C-AJ-5091; Hilti FS-ONE IMAX intumescent Firestop Sealant.

I. HVAC Ducts, Uninsulated:
1. 07.8400.56: 3 Hour Construction, penetrations through concrete/masonry walls or floors by HVAC ducts uninsulated: UL System C-AJ-7051; Hilti FS-ONE MAX Intumescent Firestop Sealant.
2. 07.8400.57: 2 Hour Construction, penetrations through concrete/masonry walls or floors by HVAC ducts uninsulated: UL System C-AJ-7111; Hilti FS-ONE MAX Intumescent Firestop Sealant.

2.18 PENETRATIONS THROUGH FLOORS BY:

A. Multiple Penetrations in Large Openings:
1. 07.8400.58: 3 Hour Construction, penetrations through concrete/masonry floors by multiple penetrations in large openings: UL System F-A-1023; Hilti CP 680-P/M Cast-In Device.
2. 07.8400.59: 2 Hour Construction, penetrations through concrete/masonry floors by multiple penetrations in large openings: UL System F-A-8012; Hilti CFS-S SIL GG Firestop Silicone Sealant Gun-Grade or CFS-S SIL SL Firestop Silicone Sealant Self-Leveling.

B. Uninsulated Metallic Pipe, Conduit, and Tubing:
1. 07.8400.60: 3 Hour Construction, penetrations through concrete/masonry floors by uninsulated metallic pipe, conduit and tubing: UL System F-A-1017; Hilti CP 680-P/M Cast-In Device.
2. 07.8400.61: 2 Hour Construction, penetrations through concrete/masonry floors by uninsulated metallic pipe, conduit and tubing: UL System F-A-1016; Hilti CP 680-P/M Cast-In Device.

C. Uninsulated Non-Metallic Pipe, Conduit, and Tubing:
   1. 07.8400.62: 3 Hour Construction, penetrations through concrete/masonry floors by uninsulated non-metallic pipe, conduit and tubing: UL System F-A-2054; Hilti CP 680-P Cast-In Device.
   2. 07.8400.63: 3 Hour Construction, penetrations through concrete/masonry floors by uninsulated non-metallic pipe, conduit and tubing: UL System F-A-2066; Hilti CP 680-P Cast-In Device.
   3. 07.8400.64: 3 Hour Construction, penetrations through concrete/masonry floors by uninsulated non-metallic pipe, conduit and tubing: UL System F-A-2213; Hilti CFS-DID Drop-In Device.
   4. 07.8400.65: 2 Hour Construction, penetrations through concrete/masonry floors by uninsulated non-metallic pipe, conduit and tubing: UL System F-A-2065; Hilti CP 680-P Cast-In Device.
   5. 07.8400.66: 2 Hour Construction, penetrations through concrete/masonry floors by uninsulated non-metallic pipe, conduit and tubing: UL System F-A-2213; Hilti CFS-DID Drop-In Device.
   6. 07.8400.67: 2 Hour Construction, penetrations through concrete/masonry floors by uninsulated non-metallic pipe, conduit and tubing: UL System F-A-2053; Hilti CP 680-P Cast-In Device.

D. Electrical Cables Not In Conduit:
   1. 07.8400.68: 3 Hour Construction, penetrations through concrete/masonry floors by electrical cables not in conduit: UL System F-A-3033; Hilti CP 680-P/M Cast-In Device.
   2. 07.8400.69: 2 Hour Construction, penetrations through concrete/masonry floors by electrical cables not in conduit: UL System F-A-3033; Hilti CP 680-P/M Cast-In Device.

E. Electrical Busways:
   1. 07.8400.70: 3 Hour Construction, penetrations through concrete/masonry floors by electrical busways: UL System C-AJ-6017; Hilti CFS-S SIL GG Firestop Silicone Sealant Gun-Grade or CFS-S SIL SL Firestop Silicone Sealant Self-Leveling.
   2. 07.8400.71: 2 Hour Construction, penetrations through concrete/masonry floors by electrical busways: UL System F-A-6002; Hilti CP 604 Self-Leveling Firestop Sealant.

F. Insulated Pipes:
   1. 07.8400.72: 3 Hour Construction, penetrations through concrete/masonry floors by insulated pipes: UL System F-A-5016; Hilti CP 680-P Cast-In Device.
   2. 07.8400.73: 3 Hour Construction, penetrations through concrete/masonry floors by insulated pipes: UL System F-A-5018; Hilti CP 680-P Cast-In Device.
   3. 07.8400.74: 2 Hour Construction, penetrations through concrete/masonry floors by insulated pipes: UL System F-A-5015; Hilti CP 680-P/M Cast-In Device.
   4. 07.8400.75: 2 Hour Construction insulated pipes: UL System F-A-5017; Hilti CP 680-P/M Cast-In Device.

2.19 PENETRATIONS THROUGH WALLS BY:

A. Uninsulated Metallic Pipe, Conduit, and Tubing:
   1. 07.8400.76: 2 Hour Construction, penetrations through concrete/masonry walls by uninsulated metallic pipe, conduit and tubing: UL System W-J-1067; Hilti FS-ONE MAX Intumescent Firestop Sealant.
   2. 07.8400.77: 1 Hour Construction, penetrations through concrete/masonry walls by uninsulated metallic pipe, conduit and tubing: UL System W-J-1067; Hilti FS-ONE MAX Intumescent Firestop Sealant.

B. Electrical Cables Not In Conduit:
   1. 07.8400.78: 2 Hour Construction, penetrations through concrete/masonry walls by electrical cables not in conduit: UL System C-AJ-3095; Hilti FS-ONE MAX Intumescent Firestop Sealant.
   2. 07.8400.79: 2 Hour Construction, penetrations through concrete/masonry walls by electrical cables not in conduit: UL System C-AJ-3216; Hilti CFS-PL Firestop Plug.

C. Insulated Pipes:

1. 07.8400.80: 2 Hour Construction, penetrations through concrete/masonry walls by insulated pipes: UL System C-AJ-5090; Hilti FS-ONE MAX Intumescent Firestop Sealant.
2. 07.8400.81: 2 Hour Construction, penetrations through concrete/masonry walls by insulated pipes: UL System C-AJ-5091; Hilti FS-ONE MAX Intumescent Firestop Sealant.
3. 07.8400.82: 1 Hour Construction, penetrations through concrete/masonry walls by insulated pipes: UL System C-AJ-5090; Hilti FS-ONE MAX Intumescent Firestop Sealant.
4. 07.8400.83: 1 Hour Construction, penetrations through concrete/masonry walls by insulated pipes: UL System C-AJ-5091; Hilti FS-ONE MAX Intumescent Firestop Sealant.

D. HVAC Ducts, Uninsulated:
1. 07.8400.84: 2 Hour Construction, penetrations through concrete/masonry walls by HVAC ducts, uninsulated: UL System W-J-7109; Hilti FS-ONE MAX Intumescent Firestop Sealant or CP 606 Flexible Firestop Sealant.

E. HVAC Ducts, Insulated:
1. 07.8400.85: 2 Hour Construction, penetrations through concrete/masonry walls by HVAC ducts, insulated: UL System W-J-7112; Hilti FS-ONE MAX Intumescent Firestop Sealant.

2.20 FIRESTOPPING PENETRATIONS THROUGH FRAMED FLOORS

A. Metallic Pipe, Conduit, and Tubing Penetrations in Framed Floors:
1. 07.8400.86: 1 Hour Construction through framed floors by metallic pipe, conduit and tubing: UL System F-C-1053; Specified Technologies Inc. WF300 Intumescent Firestop Caulk (for wood frame construction).

B. Non-Metallic Pipe, Conduit or Tubing in Framed Floors:
1. 07.8400.87: 2 Hour Construction, through framed floors by non-metallic pipe, conduit or tubing: UL System F-C-2020; Specified Technologies Inc. LCC Intumescent Firestop Collars.
2. 07.8400.88: 1 Hour Construction, through framed floors by non-metallic pipe, conduit or tubing: UL System F-C-2014; Specified Technologies Inc. WF300 Intumescent Firestop Caulk (for wood frame construction).

C. Electrical Cable in Framed Floors:
1. 07.8400.89: 1 Hour Construction, through framed floors by electrical cable: UL System F-C-3010; Specified Technologies Inc. WF300 Intumescent Firestop Caulk (for wood frame construction).

D. Insulated Pipe in Framed Floors:
1. 07.8400.90: 1 Hour Construction through framed floors by insulated pipe, conduit or tubing: UL System F-C-5043; Specified Technologies Inc. WF300 Intumescent Firestop Caulk (for wood frame construction).

2.21 FIRESTOPPING PENETRATIONS THROUGH GYPSUM BOARD WALLS

A. Blank Openings:
1. 07.8400.91: 2 Hour Construction, through gypsum board walls by blank openings: UL System W-L-3334; Hilti CP 653 Speed Sleeve.
2. 07.8400.92: 1 Hour Construction, through gypsum board walls by blank openings: UL System W-L-3334; Hilti CP 653 Speed Sleeve.

2.22 PENETRATIONS BY:

A. Multiple Penetrations in Large Openings:
1. 07.8400.93: 2 Hour Construction, through gypsum board walls by multiple penetrations in large openings: UL System W-L-1408; Hilti FS-ONE MAX Intumescent Firestop Sealant.
2. 07.8400.94: 2 Hour Construction, through gypsum board walls by multiple penetrations in large openings: UL System W-L-8071; Hilti FS-ONE MAX Intumescent Firestop Sealant.

3. 07.8400.95: 2 Hour Construction, through gypsum board walls by multiple penetrations in large openings: UL System W-L-8079; Hilti FS-ONE MAX Intumescent Firestop Sealant.
4. 07.8400.96: 1 Hour Construction, through gypsum board walls by multiple penetrations in large openings: UL System W-L-1408; Hilti FS-ONE MAX Intumescent Firestop Sealant.
5. 07.8400.97: 1 Hour Construction, through gypsum board walls by multiple penetrations in large openings: UL System W-L-8071; Hilti FS-ONE MAX Intumescent Firestop Sealant.
6. 07.8400.98: 1 Hour Construction, through gypsum board walls by multiple penetrations in large openings: UL System W-L-8079; Hilti FS-ONE MAX Intumescent Firestop Sealant.

B. Uninsulated Metallic Pipe, Conduit, and Tubing:
1. 07.8400.98: 2 Hour Construction, through gypsum board walls by uninsulated metallic pipe, conduit and tubing: UL System W-L-1054; Hilti FS-ONE MAX Intumescent Firestop Sealant.
2. 07.8400.99: 2 Hour Construction, through gypsum board walls by uninsulated metallic pipe, conduit and tubing: UL System W-L-1164; Hilti FS-ONE MAX Intumescent Firestop Sealant.
3. 07.8400.100: 2 Hour Construction, through gypsum board walls by uninsulated metallic pipe, conduit and tubing: UL System W-L-1506; Hilti CFS-D Firestop Cable Disc.
4. 07.8400.101: 1 Hour Construction, through gypsum board walls by uninsulated metallic pipe, conduit and tubing: UL System W-L-1054; Hilti FS-ONE MAX Intumescent Firestop Sealant.
5. 07.8400.102: 1 Hour Construction, through gypsum board walls by uninsulated metallic pipe, conduit and tubing: UL System W-L-1164; Hilti FS-ONE MAX Intumescent Firestop Sealant.
6. 07.8400.103: 1 Hour Construction, through gypsum board walls by uninsulated metallic pipe, conduit and tubing: UL System W-L-1506; Hilti CFS-D Firestop Cable Disc.

C. Uninsulated Non-Metallic Pipe, Conduit, and Tubing:
1. 07.8400.104 2 Hour Construction, through gypsum board walls by uninsulated non-metallic pipe, conduit and tubing: UL System W-L-2078; Hilti CP 643N/644 Firestop Collar.
2. 07.8400.105: 2 Hour Construction, through gypsum board walls by uninsulated non-metallic pipe, conduit and tubing: UL System W-L-2128; Hilti FS-ONE MAX Intumescent Firestop Sealant.
3. 07.8400.106: 1 Hour Construction, through gypsum board walls by uninsulated non-metallic pipe, conduit and tubing: UL System W-L-2078; Hilti CP 643N/644 Firestop Collar.
4. 07.8400.107: 1 Hour Construction, through gypsum board walls by uninsulated non-metallic pipe, conduit and tubing: UL System W-L-2128; Hilti FS-ONE MAX Intumescent Firestop Sealant.

D. Electrical Cables Not In Conduit:
1. 07.8400.108: 2 Hour Construction, through gypsum board walls by electrical cables not in conduit: UL System W-L-3065; Hilti FS-ONE MAX Intumescent Firestop Sealant, CP 606 Flexible Firestop Sealant, CD 601S Elastomeric Firestop Sealant, or CP 618 Firestop Putty Stick.
2. 07.8400.109: 2 Hour Construction, through gypsum board walls by electrical cables not in conduit: UL System W-L-3334; Hilti CP 653 Speed Sleeve.
3. 07.8400.110: 2 Hour Construction, through gypsum board walls by electrical cables not in conduit: UL System W-L-3393; Hilti CFS-SL RK Retrofit Sleeve Kit for existing cables.
4. 07.8400.111: 2 Hour Construction, through gypsum board walls by electrical cables not in conduit: UL System W-L-3395; Hilti CP653 Speed Sleeve.
5. 07.8400.112: 2 Hour Construction, through gypsum board walls by electrical cables not in conduit: UL System W-L-3414; Hilti CFS-D Firestop Cable Disc.

6. 07.8400.113: 1 Hour Construction, through gypsum board walls by electrical cables not in conduit: UL System W-L-3393; Hilti CFS-SL RK Retrofit Sleeve Kit for existing cables.
7. 07.8400.114: 1 Hour Construction, through gypsum board walls by electrical cables not in conduit: UL System W-L-3414; Hilti CFS-D Firestop Cable Disc.

E. Cable Trays with Electrical Cables:
1. 07.8400.115: 2 Hour Construction, through gypsum board walls by cable trays with electrical cables: UL System W-L-4011; Hilti CFS-BL Firestop Block.
2. 07.8400.116: 2 Hour Construction, through gypsum board walls by cable trays with electrical cables: UL System W-L-4060; Hilti FS-ONE MAX Intumescent Firestop Sealant.
3. 07.8400.117: 1 Hour Construction, through gypsum board walls by cable trays with electrical cables: UL System W-L-4011; Hilti CFS-BL Firestop Block.
4. 07.8400.118: 1 Hour Construction, through gypsum board walls by cable trays with electrical cables: UL System W-L-4060; Hilti FS-ONE MAX Intumescent Firestop Sealant.

F. Insulated Pipes:
1. 07.8400.119: 2 Hour Construction, through gypsum board walls by insulated pipes: UL System W-L-5028; Hilti FS-ONE MAX Intumescent Firestop Sealant.
2. 07.8400.120: 2 Hour Construction, through gypsum board walls by insulated pipes: UL System W-L-5029; Hilti FS-ONE Intumescent Firestop Sealant.
3. 07.8400.121: 1 Hour Construction, through gypsum board walls by insulated pipes: UL System W-L-5028; Hilti FS-ONE MAX Intumescent Firestop Sealant.
4. 07.8400.122: 1 Hour Construction, through gypsum board walls by insulated pipes: UL System W-L-5029; Hilti FS-ONE Intumescent Firestop Sealant.

G. HVAC Ducts, Insulated:
1. 07.8400.123: 2 Hour Construction, through gypsum board walls by HVAC ducts, insulated: UL System W-L-7156; Hilti FS-ONE MAX Intumescent Firestop Sealant.
2. 07.8400.124: 1 Hour Construction, through gypsum board walls by HVAC ducts, insulate: UL System W-L-7156; Hilti FS-ONE MAX Intumescent Firestop Sealant.

2.23 FIRESTOPPING SYSTEMS

A. Firestopping: Any material meeting requirements.
1. Fire Ratings: See drawings for required systems and ratings.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.

B. Remove incompatible materials that could adversely affect bond.

3.02 INSTALLATION

A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.

B. Install labeling required by code.

3.03 FIELD QUALITY CONTROL

A. Repair or replace penetration firestopping and joints at locations where inspection results indicate firestopping or joints do not meet specified requirements.

3.04 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.05 PROTECTION

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 079200
JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non Sag gunnable joint sealants.

B. Self-leveling pourable joint sealants.

C. Joint backings and accessories.

1.02 REFERENCE STANDARDS

A. ASTM D624 - Tear Strength Testing of Rubbers and Elastomers.

B. ASTM D638 - Standard Test Method for Tensile Properties.

C. ASTM D1640 - Standard Test Method for Drying, Curing or Film Formation of Organic Coatings.

D. ASTM D4541 - Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers

E. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer 2015.

F. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications 2018.

G. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.

H. ASTM C1193 - Standard Guide for Use of Joint Sealants 2016.

I. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants 2018.

J. ASTM C1311 - Standard Specification for Solvent Release Sealants 2014.

K. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness 2015, with Editorial Revision (2017).

L. SCAQMD 1168 - Adhesive and Sealant Applications 1989 (Amended 2017).

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.
   1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
   2. List of backing materials approved for use with the specific product.
   3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
   4. Substrates the product should not be used on.

C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.

D. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.

E. Samples for Verification: Where custom sealant color is specified, obtain directions from Engineer and submit at least two physical samples for verification of color of each required sealant.

1.04 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective work within a five-year period after Date of Substantial Completion.

C. Warranty: Include coverage for installed sealants and accessories that fail to achieve watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 JOINT SEALANT APPLICATIONS

A. Scope:
   1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to, the following items.
      a. Wall expansion and control joints.
      b. Joints between door, window, and other frames and adjacent construction.
      c. Joints between different exposed materials.
      d. Openings below ledge angles in masonry.
      e. Other joints indicated below.
   2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
      a. Joints between door, window, and other frames and adjacent construction.
      b. In sound-rated wall and ceiling assemblies, gaps at electrical outlets, wiring devices, piping, and other openings; between wall/ceiling and other construction; and other flanking sound paths.
         1) Exception: Such gaps and openings in gypsum board and plaster finished stud walls and suspended ceilings.
         2) Exception: Through-penetrations in sound-rated assemblies that are also fire-rated assemblies.
      c. Other joints indicated below.
   3. Do not seal the following types of joints.
      a. Intentional weepholes in masonry.
      b. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
      c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
      d. Joints where installation of sealant is specified in another section.
      e. Joints between suspended panel ceilings/grid and walls.

B. Interior Wet Areas: Bathrooms, restrooms, kitchens, food service areas, and food processing areas; fixtures in wet areas include plumbing fixtures, food service equipment, countertops, cabinets, and other similar items.

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

2.02 JOINT SEALANTS - GENERAL

A. Sealants and Primers: Provide products having lower volatile organic compound (VOC) content than indicated in SCAQMD 1168.

B. Colors: As indicated on drawings.

2.03 NON SAG JOINT SEALANTS

A. (07.9200.01) Non-staining Silicone sealant; Grade NS

B. Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
   1. Movement Capability: Plus and minus 50 percent, minimum.
   2. Non-Staining To Porous Stone: Non-staining to light-colored natural stone when tested in accordance with ASTM C1248.
   3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
   4. Hardness Range: 15 to 35, Shore A, when tested in accordance with ASTM C661.
   5. Color: To be selected by Engineer from manufacturer's standard range.
   6. Manufacturers:
      a. Dow Chemical Company; DOWSIL 756 SMS Building Sealant: consumer.dow.com/en-us/industry/ind-building-construction.html/#sle.
      b. Dow Chemical Company; DOWSIL 790 Silicone Building Sealant: consumer.dow.com/en-us/industry/ind-building-construction.html/#sle.

c. Dow Chemical Company; DOWSIL 791 Silicone Weatherproofing Sealant: consumer.dow.com/en-us/industry/ind-building-construction.html/#sle.
d. Dow Chemical Company; DOWSIL 795 Silicone Building Sealant: consumer.dow.com/en-us/industry/ind-building-construction.html/#sle.
e. Pecora Corporation; Pecora 890 NST (Non-Staining Technology): www.pecora.com/#sle.
f. Pecora Corporation; Pecora 864 NST (Non-Staining Technology): www.pecora.com/#sle.
g. Sika Corporation; Sikasil WS-290: www.usa-sika.com/#sle.
h. Sika Corporation; Sikasil WS-295: www.usa-sika.com/#sle.
i. Sika Corporation; Sikasil 728NS: www.usa-sika.com/#sle.
j. Substitutions: See Section 016000 - Product Requirements.

C. (07.9200.02) Silicone sealant: Grade NS, Use T; single-component, for traffic exposure

D. Silicone Sealant: ASTM C920, Grade NS, Use T; single-component, explicitly approved by manufacturer for traffic exposure when recessed below traffic surface; not expected to withstand continuous water immersion.
1. Movement Capability: Plus 100 percent and minus 50 percent, minimum.
2. Color: To be selected by Engineer from manufacturer's standard range.
3. Manufacturers:
a. Dow Chemical Company; DOWSIL NS Parking Structure Sealant: consumer.dow.com/en-us/industry/ind-building-construction.html/#sle.
b. Pecora Corporation; Pecora 301 NS (Non-Sag): www.pecora.com/#sle.
c. Tremco Commercial Sealants & Waterproofing; Spectrem 800: www.tremcosealants.com/#sle.
d. Substitutions: See Section 016000 - Product Requirements.

E. (07.9200.03) Silicone sealant; Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.

F. Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 25 percent, minimum.
2. Hardness Range: 15 to 35, Shore A, when tested in accordance with ASTM C661.
3. Color: To be selected by Engineer from manufacturer's standard range.
4. Cure Type: Single-component, neutral moisture curing
5. Service Temperature Range: Minus 65 to 180 degrees F (Minus 54 to 82 degrees C).
6. Manufacturers:
a. Franklin International, Inc; Titebond 100% Silicone Sealant: www.titebond.com/#sle.
b. Dow Chemical Company; DOWSIL 999-A Building and Glazing Sealant: consumer.dow.com/en-us/industry/ind-building-construction.html/#sle.
c. Pecora Corporation; Pecora 860: www.pecora.com/#sle.
d. Pecora Corporation; Pecora 890FTS-TXTR (Field Tintable Textured): www.pecora.com/#sle.
e. Sherwin-Williams Company; Silicone Rubber All Purpose Sealant: www.sherwin-williams.com/#sle.
f. Sika Corporation; Sikasil GP: www.usa-sika.com/#sle.
g. Sika Corporation; Sikasil WS-295: www.usa-sika.com/#sle.
h. Sika Corporation; Sikasil N-Plus US: www.usa-sika.com/#sle.
i. Sika Corporation; Sikasil 728NS: www.usa-sika.com/#sle.
j. Substitutions: See Section 016000 - Product Requirements.

G. (07.9200.04) Mildew-resistant silicone sealant, Grade NS, single component

H. Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
1. Color: to be selected by Engineer from manufacturer's standard color selection.
2. Manufacturers:

a. Pecora Corporation; Pecora 898 NST (Non-Staining Technology): www.pecora.com/#sle.
b. Sika Corporation; Sikasil GP: www.usa-sika.com/#sle.
c. Substitutions: See Section 016000 - Product Requirements.

I. (07.9200.05) Polymer Sealant; single component, paintable, mold/mildew and UV resistant

J. Polymer Sealant: ASTM C920; single component, cured sealant is paintable and mold/mildew resistant, low odor and VOC, and ultraviolet (UV) resistant.
1. Adheres to wet surfaces.
2. Color: to be selected by Engineer from manufacturer's standard color selection.
3. Manufacturers:
a. ADFAST Corporation; ADSEAL DWSP 1940 Series: www.adfastcorp.com/#sle.
b. DAP Products Inc; DYNAFLEX 800 Sealant: www.dapspecline.com/#sle.

K. (07.9200.06) Hybrid Urethane Sealant, Grade NS, single component

L. Hybrid Urethane Sealant: ASTM C920, Grade NS, Uses M and A; single component; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 35 percent, minimum.
2. Hardness Range: 20 to 40, Shore A, when tested in accordance with ASTM C661.
3. Manufacturers:
a. Franklin International Inc; Titebond WeatherMaster ULTIMATE MP Sealant: www.titebond.com/#sle.
b. Master Builders Solutions by BASF; MasterSeal NP100: www.master-builders-solutions.basf.us/en-us/#sle.
c. Sherwin-Williams Company; Stampede 100 Low-Modulus Hybrid Urethane Sealant: www.sherwin-williams.com/#sle.
d. Sherwin-Williams Company; Stampede 1H Hybrid Sealant: www.sherwin-williams.com/#sle.
e. Substitutions: See Section 016000 - Product Requirements.

M. (07.9200.07) Tamper-Resistant, Silyl-Terminated Polyether (STPE) and Polyurethane (STPU) Sealant, Grade NS, single component

N. Tamper-Resistant, Silyl-Terminated Polyether (STPE) and Polyurethane (STPU) Sealant: ASTM C920, Grade NS, Uses M and A; single component; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 50 percent, minimum
2. Hardness Range: 25 to 30, Shore A, when tested in accordance with ASTM C661.
3. Color: To be selected by Engineer from manufacturer's standard range.
4. Manufacturers:
a. Pecora Corporation; DynaFlex SC (Security Sealant): www.pecora.com/#sle.
b. Sika Corporation; SikaHyflex-150 LM: www.usa-sika.com/#sle.
c. Substitutions: See Section 016000 - Product Requirements.

O. (07.9200.08) Polyurethane Sealant, Grade NS, single or multi-component

P. Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 50 percent, minimum.
2. Color: To be selected by Architect from manufacturer's standard range.
3. Service Temperature Range: Minus 40 to 180 degrees F (Minus 40 to 82 degrees C).
4. Manufacturers:
a. Master Builders Solutions by BASF; MasterSeal NP1: www.master-builders-solutions.basf.us/en-us/#sle.
b. Pecora Corporation; DynaFlex: www.pecora.com/#sle.
c. Sika Corporation; Sikaflex-1a: www.usa-sika.com/#sle.
d. Sika Corporation; Sikaflex-15 LM: www.usa-sika.com/#sle.
e. Sika Corporation; Sikaflex-2c NS: www.usa-sika.com/#sle.
f. Substitutions: See Section 016000 - Product Requirements.

Q. (07.9200.09) Acrylic-Urethane Sealant, Grade NS, single component; paintable

R. Acrylic-Urethane Sealant: ASTM C920, Grade NS, Uses M and A; single component; paintable; not expected to withstand continuous water immersion or traffic.
   1. Movement Capability: Plus and minus 12-1/2 percent, minimum.
   2. Color: selected by Engineer from manufacturer's standard color selection.
   3. Manufacturers:
      a. DAP Products Inc; DYNAFLEX 920 Sealant: www.dapspecline.com/#sle.
      b. Sherwin-Williams Company; Shermax Urethanized Elastomeric Sealant: www.sherwin-williams.com/#sle.
      c. Substitutions: See Section 016000 - Product Requirements.

S. (07.9200.10) Butyl Sealant: Solvent-based; single component, non sag

T. Butyl Sealant: Solvent-based; ASTM C1311; single component, non sag; not expected to withstand continuous water immersion or traffic.
   1. Hardness Range: 10 to 30, Shore A, when tested in accordance with ASTM C661.
   2. Color: To be selected by Engineer from manufacturer's standard range.
   3. Manufacturers:
      a. Pecora Corporation; Pecora BC-158 Butyl Rubber Sealant: www.pecora.com/#sle.
      b. Sherwin-Williams Company; Storm Blaster All Season Sealant: www.sherwin-williams.com/#sle.
      c. Substitutions: See Section 016000 - Product Requirements.

U. (07.9200.11) Non-Curing Butyl Sealant: Solvent-based, single component, non-sag, non-skinning, non-hardening, non-bleeding; non-vapor-permeable; intended for fully concealed applications.

V. Non-Curing Butyl Sealant: Solvent-based, single component, non-sag, non-skinning, non-hardening, non-bleeding; non-vapor-permeable; intended for fully concealed applications.
   1. Manufacturers:
      a. Pecora Corporation; Pecora BA-98 Non-Skinning Butyl Sealant: www.pecora.com/#sle.
      b. Substitutions: See Section 016000 - Product Requirements.

2.04 SELF-LEVELING SEALANTS

A. (07.9200.12) VersaFlex SL/75 is a semi-rigid self-leveling Polyurea joint filler

B. VersaFlex SL/75 is a semi-rigid self-leveling Polyurea joint filler used to fill interior random cracks, control joints, or new construction joints on horizontal concrete surfaces.

C. Semi-Rigid Self-Leveling Polyurea Joint Filler: Two-component, 100 percent solids; intended for filling cracks and control joints not subject to significant movement; rigid enough to support concrete edges under traffic.
   1. SL/75 is designed specifically for industrial floor applications receiving heavy vehicle traffic, such a forklift or steel wheeled carts. **SL/75** is flexible, accommodating to small slab movement yet strong enough to protect the vertical edges of concrete from spalling under extreme loading. SL/75 can be used in exterior applications where little joint or crack movement from thermal cycling will occur. SL/75 is recommended for repair of cracks, damaged control joints or new construction joints in cold storage facilities, freezers, and food processing plants where time and temperature are serious considerations.
   2. Physical Properties:

Mix Ratio	1:1
VOC	0
Gel Time, ASTM D1640	~ 1 Minute
Tack Free, ASTM D1640	2 - 3 Minutes
Open to Foot Traffic, ASTM D1640	60 Minutes
Tensile Strength (psi) ASTM D638	600 - 1200
Tensile Elongation (%) ASTM D638	240 - 500
Modulus of Elasticity (psi) ASTM D638	400 - 900
Adhesion to concrete (psi) ASTM D4541	300 - 450

Tear Strength (lb/in) ASTM D624	150 - 300
Shore A Hardness ASTM D2240	≥ 75
Tabor Abrasion, mg wt loss; (1000g, 1000 revs, H-18) ASTM D4060	375 - 500

3. Durometer Hardness, Type A: 75, minimum, after seven days when tested in accordance with ASTM D2240.
4. Color: To be selected by Engineer from manufacturer's standard colors.
5. Manufacturers:
   a. Versa Flex, Inc.; VersaFlex S/L 75: www.versaflex.com
   b. Substitutions: See Section 016000 - Product Requirements.

D. (07.9200.13) Polyurethane-Methacrylate (PUMA) Expansion Joint System

E. Polyurethane-Methacrylate (PUMA) Expansion Joint System: Intended for expansion joints in exposed multi-story parking garages, and includes aluminum tape, primer, joint compound material, and top coat.
   1. Durometer Hardness, Shore A: 65 to 87, minimum, when tested in accordance with ASTM D2240.
   2. Color: To be selected by Engineer from manufacturer's standard colors.
   3. Manufacturers:
      a. Tremco Commercial Sealants & Waterproofing; Tremco PUMA Expansion Joint System (EJS): www.tremcosealants.com/#sle.
      b. Substitutions: See Section 016000 - Product Requirements.

2.05 ACCESSORIES

A. (07.9200.14) Backer Rod: Cylindrical cellular foam rod

B. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.
   1. Manufacturers:
      a. ADFAST Corporation; ADSEAL BR-2600 (Backer Rod): www.adfastcorp.com/#sle.
      b. Nomaco, Inc: www.nomaco.com/#sle.
      c. Substitutions: See Section 016000 - Product Requirements.

C. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joints are ready to receive work.

B. Verify that backing materials are compatible with sealants.

C. Verify that backer rods are of the correct size.

3.02 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

3.03 INSTALLATION

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Perform installation in accordance with ASTM C1193.

C. Perform acoustical sealant application work in accordance with ASTM C919.

D. Install bond breaker backing tape where backer rod cannot be used.

E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

F. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.

G. Non sag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

H. Concrete Floor Joint Filler: After full cure, shave joint filler flush with top of concrete slab.

END OF SECTION

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SECTION 081113
HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-fire-rated hollow metal doors and frames.

B. Fire-rated hollow metal doors and frames.

C. Thermally insulated hollow metal doors with frames.

D. Hollow metal borrowed lite glazing frames.

E. Accessories, including glazing, louvers, and matching panels.

1.02 RELATED REQUIREMENTS

A. Section 087100 - Door Hardware.

B. Section 088000 - Glazing: Glass for doors and borrowed lite.

1.03 ABBREVIATIONS AND ACRONYMS

A. ANSI: American National Standards Institute.

B. ASCE: American Society of Civil Engineers.

C. HMMA: Hollow Metal Manufacturers Association.

D. NAAMM: National Association of Architectural Metal Manufacturers.

E. NFPA: National Fire Protection Association.

F. SDI: Steel Door Institute.

G. UL: Underwriters Laboratories.

1.04 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.

B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors 2011.

C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100) 2017.

D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames 2011.

E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.

F. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable 2021.

G. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength 2018a.

H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.

I. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 2009 (Reapproved 2016).

J. ASTM E413 - Classification for Rating Sound Insulation 2016.

K. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames 2016.

L. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

M. ITS (DIR) - Directory of Listed Products current edition.

N. NAAMM HMMA 805 - Recommended Selection and Usage Guide for Hollow Metal Doors and Frames 2012.

O. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames 2002.

P. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames 2011.

Q. NAAMM HMMA 840 - Guide Specifications For Receipt, Storage and Installation of Hollow Metal Doors and Frames 2007.

R. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames 2014.

S. NAAMM HMMA 867 - Guide Specifications for Commercial Laminated Core Hollow Metal Doors and Frames 2016.

T. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2019.

U. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies 2017.

V. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames 2013.

W. UL (DIR) - Online Certifications Directory Current Edition.

X. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies Current Edition, Including All Revisions.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.

C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

D. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.

1.06 QUALITY ASSURANCE

A. Maintain at project site copies of reference standards relating to installation of products specified.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.01 HOLLOW METAL DOOR ELEMENTS

A. (08.1113.01) Exterior hollow metal insulated door.

B. (08.1113.03) Interior hollow metal fire rated door.

2.02 HOLLOWMETAL FRAME ELEMENTS

A. (08.1113.31) Welded exterior HM door frame.

B. (08.1113.33) Welded interior HM non-rated door frame.

C. (08.1113.37) Welded interior fire rated HM frame.

2.03 MANUFACTURERS

A. Hollow Metal Doors and Frames:
   1. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com.
   2. Republic Doors, an Allegion brand: www.republicdoor.com/#sle.
   3. Steelcraft, an Allegion brand: www.allegion.com/sle.
   4. Substitutions: See Section 016000 - Product Requirements.

2.04 PERFORMANCE REQUIREMENTS

A. Requirements for Hollow Metal Doors and Frames:

1. Steel Sheet: Comply with one or more of the following requirements; galvannealed steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
2. Accessibility: Comply with ICC A117.1 and ADA Standards.
3. Door Edge Profile: Manufacturers standard for application indicated.
4. Typical Door Face Sheets: Flush.
5. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Manufacturers standard.
6. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

B. Hollow Metal Panels: Same construction, performance, and finish as doors.

C. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.05 HOLLOW METAL DOORS

A. (08.1113.01) Exterior hollow metal insulated door.

B. Exterior Doors: Hollow Metal, Thermally insulated. [<>]
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
   a. Level 2 - Heavy-duty.
   b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
   c. Model see drawings.
   d. Door Face Metal Thickness: 18 gage, 0.042 inch (1.0 mm), minimum.
   e. Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M.
2. Door Core Material: Manufacturers standard core material/construction and in compliance with requirements.
3. Door Thickness: 1-3/4 inches (44.5 mm), nominal.
4. Weatherstripping: Refer to Section 087100.
5. Door Finish: Factory primed and field finished.

C. (08.1113.02) Interior hollow metal non-rated door.

D. Interior Doors, Hollow Metal, Non-Fire Rated:
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
   a. Level 2 - Heavy-duty.
   b. Physical Performance Level B 500 000 cycles; in accordance with ANSI/SDI A250.4.
   c. Model see drawings.
   d. Door Face Metal Thickness: 18 gage, 0.042 inch (1.0 mm), minimum.
2. Door Core Material: Manufacturers standard core material/construction and in compliance with requirements.
3. Door Thickness: 1-3/4 inches (44.5 mm), nominal.

E. (08.1113.03) Interior hollow metal fire rated door.

F. Fire-Rated Interior Hollow Metal Doors:
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
   a. Level 2 - Heavy-duty.
   b. Physical Performance Level B 500 000 cycles; in accordance with ANSI/SDI A250.4.
   c. Model see drawings.
   d. Door Face Metal Thickness: 18 gage, 0.042 inch (1.0 mm), minimum.
   e. Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M.
2. Fire Rating: As indicated on Door Schedule, tested in accordance with UL 10C and NFPA 252 ("positive pressure fire tests").

3. Provide units listed and labeled by UL (DIR) or ITS (DIR).
   a. Attach fire rating label to each fire rated unit.
4. Door Thickness: 1-3/4 inches (44.5 mm), nominal.

2.06 HOLLOW METAL FRAMES

A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.

B. 08.1113.31: Welded exterior HM door frame.

C. Exterior Door Frames: Face welded type, galvanized.
   1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A40/ZF120 coating.
   2. Frame Metal Thickness: 16 gage, 0.053 inch (1.3 mm), minimum.
   3. Frame Finish: Factory primed and field finished.
   4. Weatherstripping: Separate, see Section 087100.

D. Interior Door Frames, Non-Fire Rated: Face welded type.
   1. Frame Metal Thickness: 16 gage, 0.053 inch (1.3 mm), minimum.
   2. Frame Finish: Factory primed and field finished.

E. 08.1113.34: KD interior HM non-rated door frame.

F. Interior Door Frames, Non-Fire Rated: Knock-down type.
   1. Frame Metal Thickness: 16 gage, 0.053 inch (1.3 mm), minimum.
   2. Frame Finish: Factory primed and field finished.

G. Door Frames, Fire-Rated: Face welded type.
   1. Fire Rating: Same as door, labeled.
   2. Frame Metal Thickness: 16 gage, 0.053 inch (1.3 mm), minimum.
   3. Frame Finish: Factory primed and field finished.
   4. Frame Metal Thickness: 18 gauge, 0.042 inch (1.0 mm), minimum.
   5. Frame Finish: Factory primed and field finished.

2.07 FINISHES

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

2.08 ACCESSORIES

A. Glazing: As specified in Section 088000, factory installed.

B. Mechanical Fasteners for Concealed Metal-to-Metal Connections: Self-drilling, self-tapping, steel with electroplated zinc finish.

C. Polyurethane Foam for Setting Frames:
   1. Soudafoam Door & Window; by Soudal Accumetric, 350 Ring Road, Elizabethtown, KY 42701; (877)-873-8739. www.soudalusa.com; e-mail: info@soudalusa.com.
   2. Penosil Premium FireRated Gunfoam B1; www.penosil.com
   3. OSI Quad Foam; www.ositough.com
   4. Substitutions: or equal per section 01 6000 Product Requirements.

D. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.

E. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.

B. Install fire rated units in accordance with NFPA 80.

C. Coordinate frame anchor placement with wall construction.

D. Polyurethane punch and dimpled frames in wood, metal, concrete and masonry construction, gun method; brace frames so that pressure of foam before setting will not deform frames.

E. Caulk perimeter of frame both sides with Silicone sealant per section 07 9200.

F. Install door hardware as specified in Section 087100.

G. Comply with glazing installation requirements of Section 088000.

H. Touch up damaged factory finishes.

3.02 TOLERANCES

A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.

B. Maximum Diagonal Distortion: 1/16 inch (1.6 mm) measured with straight edge, corner to corner.

3.03 ADJUSTING

A. Adjust for smooth and balanced door movement.

END OF SECTION

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SECTION 083322
OVERHEAD COILING DOORS

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ASTM E413 - Classification for Rating Sound Insulation 2016.

B. ANSI/DASMA 108 - American National Standards Institute Standard Method For Testing Sectional Garage Doors And Rolling Doors: Determination Of Structural Performance Under Uniform Static Air Pressure Difference.

C. ANSI/DASMA 203 - American National Standards Institute Specifications for non-rated fire rolling doors published by Door & Access Systems Manufacturers Association International.

D. ASTM A123 - Zinc hot-dipped galvanized] coatings on iron and steel products.

E. ASTM A229 - Steel wire, oil-tempered for mechanical springs.

F. ASTM A653 - Steel sheet, zinc-coated galvanized by the hot-dipped process, commercial quality.

G. ASTM E330 - Structural performance of exterior windows, curtain walls, and doors by uniform static air pressure difference.

1.02 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

C. Shop Drawings: Include detailed plans, elevations, details of framing members, anchoring methods, required clearances, hardware, and accessories. Include relationship with adjacent construction.

D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

E. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) long, representing actual product, color, and patterns.

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

G. Closeout Submittals: Provide manufacturer’s maintenance instructions that include recommendations for periodic checking, adjustment and lubrication of components.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in performing Work of this section with a minimum of five years' experience in the fabrication and installation of security closures.

B. Installer Qualifications: Installer Qualifications: Company specializing in performing Work of this section with minimum three years and an authorized Wayne Dalton installer.

C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
   1. Finish areas designated by Engineer.
   2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Engineer.
   3. Refinish mock-up area as required to produce acceptable work.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging with seals and labels intact until ready for installation.

B. Store materials off the ground in a dry, warm, ventilated weathertight location.

1.05 SEQUENCING

A. Ensure that locating templates and other information required for installation of products of this section are furnished to affected trades in time to prevent interruption of construction progress.

B. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.06 FIELD CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.07 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Provide Rolling Steel Service doors and Rolling Steel Fire doors with limited 2 Year Warranty on defects in materials and workmanship on the door; excludes the counterbalance spring and finish.

C. Provide rolling steel Advanced Performance service doors with limited 5 Year Warranty on all doors system materials and workmanship.

D. Provide Aluminum Security Shutters, Model 523 with limited 2 Year Warranty on defects in materials and workmanship on the door and components. Provide Powder Coat Finish with a 2 years warranty against excessive fading, cracking, blistering, flaking or peeling.

PART 2 PRODUCTS

2.01 OVERHEAD COILING DOORS -- PRODUCTS

A. (08.3322.01) Wayne Dalton Model 800C Insulated Rolling Service Doors:

B. (08.3322.02) Wayne Dalton Model 800 Rolling Service Doors:

C. (08.3322.20) Genie Commercial Operator Model GCL - GH

2.02 MANUFACTURERS

A. Acceptable Manufacturer: Wayne Dalton; 2501 S. State Highway 121 Business, Suite 200, Lewisville, TX 75067. ASD. Phone: (800) 827-3667; Web Site: www.wayne-dalton.com. Email: info@wayne-dalton.com.

B. Substitutions: See Section 016000 - Product Requirements.

2.03 ROLLING STEEL SERVICE DOORS

A. **Wayne Dalton Model 800 Rolling Service Doors:**

1. Description:
   a. Maximum Width: 40 feet
      1) Maximum Height: 40 feet
   b. Curtain: composed of interlocking roll-formed slats.
      1) Slat Profiles/Material:
         (a) No. 4 Curved-faced single crown slat: 20-gauge steel.
         (b) No. 14 Flat-faced slat: 22-gauge steel., 20-gauge steel., 18-gauge steel., 16-gauge steel., 22-gauge stainless steel., 20-gauge stainless steel., 18-gauge stainless steel., 16-gauge aluminum., or 14-gauge aluminum.
      2) Ends of alternate slats fitted with metal endlocks/windlocks.
   c. Bottom Bar: Consists of two equal angles, 0.12 inch minimum thickness, to stiffen curtain, with astragal. Angle shall be: Steel
   d. Guides:
      1) Roll-formed steel channel bolted to wall.
      2) Roll-formed steel channel bolted to three structural angle guide angle assembly forming a slot to retain curtains in guides. Structural grade, three angle assembly fabricated of: Steel
      3) Provide with integral windlock bars and removable bottom bar stops.

e. Brackets: Design to enclose ends of coil and provide support for counterbalance pipe at each end. Fabricate of steel plates, with permanently sealed ball bearings. Thickness shall be: 1/4 inch minimum
f. Counterbalance: Curtain to be coiled on a pipe of sufficient size to carry door load with deflection not to exceed 0.033 inch per foot of door span. Curtain to be correctly balanced by helical springs, oil tempered torsion type. Cast iron barrel plugs will be used to anchor springs to tension shaft and pipe.
g. Hood: Hood to enclose curtain coil and counterbalance mechanism. Hood fabricated of sheet metal, flanged at top for attachment to header and flanged at bottom to provide longitudinal stiffness. Fabricate of: Minimum 24-gauge galvanized steel.
h. Finish: Shop coat of rust inhibitive primer on non-galvanized surfaces and operating mechanisms. Guides and bracket plates will be coated with a flat black prime paint.
   1) Galvanized Steel: Powdercoat finish as selected from manufacturer's RAL color selections.
   2) Aluminum Finish: Mill finish., Clear anodized., or Bronze anodized.
   3) Stainless Steel finish: #4 finish.
i. Operation: Door will be operated by means of: Manual, lift-up., Chain hoist., Awning crank., Wall crank box., Motor operation., Motor operation with electrical sensing edge attached to bottom bar to stop and reverse door when it contacts an object during the closing cycle., or Motor operation with pneumatic sensing edge attached to bottom bar to stop and reverse door when it contacts an object during the closing cycle.
j. Detectors:
   1) An infrared photocell installed inside the side guide and detecting the presence of a pedestrian or a vehicle. Upon activation, it opens the door immediately and keeps it open as long as the presence is detected.
   2) Height of photocell: 12 inches (305 mm) from the floor.
   3) Height of photocell: Up to maximum 24 inches (610 mm) from the floor.
   4) A bottom edge detector opens the door when it hits an obstacle during the closing cycle. This detector is positioned at the bottom part of the curtain.

2. Space Requirements: All indicated dimensions are net: the additional space necessary for mounting and maintenance has to be taken into account. Reduced dimensions upon request. Refer to drawings.
3. Weatherstripping: Bottom astragal, optional surface guide weatherstrip, and internal hood baffle.
4. Locking: Electric-motor operation doors provided with lock through the operator gearing.
5. Windload: Windload minimum 115 psf per DASMA 102-2012 and as required by local codes.
6. Mounting: Steel jambs.

2.04 GENIE COMMERCIAL LINE GEAR HEAD CHAIN HOIST

A. General
1. The electric door operator shall be the Model GCL Heavy-Duty door control system for a rolling steel door as manufactured by The Genie Company and suitable for the type and size of door specified. www.geniecompany.com/commercial.
2. The electric operator shall be three phase with MultiVolt™ - the ability to adjust to the correct voltage of 208/230/460 for three phase without removal or addition of any parts. (The electric operator shall be 575VAC three phase).
3. All components to have corrosion resistant coatings.
4. The operator shall be suited for NEMA ICS 6 Type 1, NEMA ICS 6 Type 4, or NEMA ICS 6 Type 4X environment.

B. Motor
1. Motor shall be: 3 horsepower three phase with automatic thermal reset overload.
2. Motor frame shall comply with NEMA 56 for ½ HP three phase, ¾, 1 and 3 HP all phases, open drip-proof construction, Totally Enclosed Non Ventilated – TENV construction, and Totally Enclosed Fan Cooled – TEFC construction.

C. Reduction
   1. Primary reduction is worm gear in oil bath (secondary reduction is by chain and sprocket).

D. Duty Cycle
   1. Duty cycle shall accommodate heavy usage, up to 60 cycles per hour under a large constant load.

E. Brake
   1. Brake shall be a DC disc type with selectable progressive braking for smooth stopping.

F. Optional Clutch to be included
   1. Clutch shall be adjustable torque-limiter type.

G. Control System
   1. The control system shall be microprocessor based with relay motor controls on a single board. This system will incorporate a 16-character Liquid Crystal Display (LCD) to display the system status. This system shall be capable of monitoring and reporting on a variety of operating conditions, including:
      a. Current operating status,
      b. Current command status,
      c. Motor movement status,
      d. Current error status (if applicable),
      e. Hoist Interlock status (if applicable),
      f. External Interlock status,
      g. And 24VDC status.
   2. The control system shall feature a delay-on-reverse operating protocol.
   3. The system shall include maximum run timers in both directions of travel that limit motor run time in the event a clutch slips or some other problem occurs.
   4. It shall include provisions for the connection of a 2-wire monitored photocell system or a 2-wire monitored edge sensor, as well as non-monitored 2-wire sensing edges, photocells or other entrapment protection devices.
   5. Control action will be constant contact close until a monitored entrapment device is installed, allowing for selection of momentary contact.
   6. The system shall include provisions for connection of an external, 3-wire radio control, and single and/or 3-button control stations.
   7. The control system shall include on board open, close and stop control keys for local operation.
   8. Trolley operators shall include an inherent secondary reversal system.
   9. The control system will include an IntelliCode® I radio receiver that is 315 MHz and capable of storing 50 single button and/or 50 Open-Close-Stop transmitters with the ability to add and/or delete transmitters individually, identify and store activating transmitter ID(s).

H. Mounting
   1. Mounting for sectional doors shall be by jackshaft that is side mount or center mount chain/sprocket coupling to door trolley, side-mount trolley, or dual trolley.
   2. Mounting for rolling steel doors shall be front of hood or wall-mount and chain/sprocket coupling to door.
   3. Mounting for hoist models shall be left hand or right hand field adjustable.

I. Release
   1. Release shall be a pull and hold type mechanism with single cable operation and an integrated interlock switch on hoist units. or Release shall consist of a manual disconnect door arm on trolley units.

J. Hoist
   1. Chain hoist shall consist of chain pocket wheel, chain guard and smooth hand chain on hoist units. Standard on hoist models (optional on trolley as side mount kit).

K. Secondary Reversal
   1. ATrolley version only shall include an integral electronic reversing system that will stop and reverse a closing door upon detection of an obstruction and designed to accept an optional external reversing device.

2. Hoist versions shall be designed to accept an optional external reversing device.

L. Optional Control Accessories
1. Control accessories: In lieu of or addition to: interior push-button control station, exterior push-button control station, interior key switches, exterior key switches), radio control, Genie monitored photo electric eyes, floor loops, or motion sensors.
2. Operator Accessories shall be Timer to Close and will provide auxiliary control inputs, auxiliary safety inputs, auxiliary timer hold input, and an automatic door closing feature with a user selectable time delay. Safety inputs are to be enabled or disabled using the on board keypad.
3. Operator Accessories shall be Auxiliary Output Module and will provide several auxiliary sets of dry contacts that are microprocessor controlled. Provides contacts for up, down, or mid-stop limit. Provides contacts to be configured using the on board keypad to activate lights, horn, and strobes while door is running up, down, and both up and down.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. Examine conditions of substrates, supports, and other conditions under which this work is to be performed.

C. If substrate preparation is the responsibility of another installer, notify Engineer of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install rolling fire doors in accordance with the manufacturer’s instructions and in accordance with the requirements of the National Fire Protection Association Standard 80 (NFPA 80).

C. Install door complete with necessary hardware, jamb and head mold strips, anchors, inserts, hangers, and equipment supports in accordance with final shop drawings, manufacturers instructions, and as specified herein.

D. Fit, align and adjust rolling door assemblies level and plumb for smooth operation.

E. Upon completion of final installation, lubricate, test and adjust doors to operate easily, free from warp, twist or distortion and fitting for entire perimeter.

F. The Model GCL Heavy Duty™ shall be installed in accordance with The Genie Company instructions and standards. Installation will be by trained and authorized Genie Company distributors or dealers.

3.04 TESTING

A. Drop-test rolling steel fire doors in accordance with NFPA 80 and witnessed, attesting to their successful operation at the time of installation.

3.05 MAINTENANCE

A. Per NFPA 80, paragraph 15-2 4.3: All horizontal or vertical sliding and rolling fire doors shall be inspected and tested annually to check for proper operation and full closure. Resetting of the release mechanism shall be done in accordance with the manufacturer's instructions. A written record shall be maintained by the building owner and made available to the authority having jurisdiction.

3.06 ADJUSTING

A. Test for proper operation and adjust as necessary to provide proper operation without binding or distortion.

B. Adjust hardware and operating assemblies for smooth and noiseless operation.

3.07 CLEANING

A. Clean curtain and components using non-abrasive materials and methods recommended by manufacturer.

B. Remove labels and visible markings.

C. Touch-up, repair or replace damaged products before Substantial Completion.

3.08 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 083613
SECTIONAL DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Insulated Sectional Overhead Doors.

B. Electric Operators and Controls.

C. Operating Hardware, tracks, and support.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-In-Place Concrete: Prepared opening in concrete. Execution requirements for placement of anchors in concrete wall construction.

B. Section 26 05 33 - Raceway and Boxes: Empty conduit from control station to door operator.

1.03 REFERENCE STANDARDS

A. ASTM A413/A413M - Standard Specification for Carbon Steel Chain 2021.

B. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 2009 (Reapproved 2016).

C. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen 2019.

D. NFRC (CPD) - Certified Product Directory - National Fenestration Rating Council Current Edition.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

C. Shop Drawings: Indicate plans and elevations including opening dimensions and required tolerances, connection details, anchorage spacing, hardware locations, and installation details.

D. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

E. Operation and Maintenance Data.

1.05 QUALITY ASSURANCE

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

B. Installer Qualifications: Authorized representative of the manufacturer with minimum five years documented experience.

C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories, Inc. acceptable to authority having jurisdiction as suitable for purpose specified.

1.06 PROJECT CONDITIONS

A. Pre-Installation Conference: Convene a pre-installation conference just prior to commencement of field operations, to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work.

1.07 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Warranty: Manufacturer’s limited door and operators System warranty for 10 years against cracking, splitting or deterioration of steel skin due to rust.

C. Warranty: Manufacturer's limited door and operators System warranty for 8 years against cracking, splitting or deterioration due to rust-through.

PART 2 PRODUCTS

2.01 SECTIONAL OVERHEAD DOOR ELEMENTS

A. (08.3613.13) Wayne Dalton C-20 series steel doors

2.02 MANUFACTURERS

A. Acceptable Manufacturer: Wayne Dalton; 2501 S. State Highway 121 Business, Suite 200, Lewisville, TX 75067. ASD. Phone: (800) 827-3667; Web Site: www.wayne-dalton.com. Email: info@wayne-dalton.com.

B. Substitutions: See Section 016000 - Product Requirements.

2.03 INSULATED SECTIONAL OVERHEAD DOORS

A. **Sectional Overhead Steel Doors: Wayne Dalton C-20 Series Steel Doors**.

B. Units shall have the following characteristics:
   1. Door Assembly: Steel door assembly of roll formed steel type with ship lap meeting rails and box shaped 20 gauge stile construction.
   2. Panel Thickness: 2 inches (51 mm).
   3. Exterior Surface: Ribbed.
   4. Section Material: 20 gauge, galvanized steel.
   5. Insulation: Insulation held in place with polymer clips. Provides an R-value up to 7.64
   6. Insulation covered with .022 inch minimum embossed pre-painted white steel.
   7. Center and End Stiles: 20 gauge steel.
   8. Springs: Standard cycle spring: 10,000 cycles and High cycle spring: 50,000 cycles.
   9. Finish and Color: Two coat baked-on polyester:
   10. White color.
   11. Lock:
      a. Interior mounted slide lock.
   12. Weatherstripping:
      a. Flexible bulb-type strip at bottom section.
      b. Flexible Jamb seals.
      c. Flexible Header seal.
   13. Track: Provide track as recommended by manufacturer to suit loading required and clearances available.
      a. Size:
         1) 2 inch (51 mm).
      b. Type:
         1) Vertical lift.
      c. Vertical track shall be graduated to provide wedge type weathertight closing with continuous angle mounting for steel or wood jambs, and shall be fully adjustable to seal door at jambs.
      d. Electric Motor Operation: Provide UL listed electric operator, equal to Genie Commercial Operators, size and type as recommended by manufacturer to move door in either direction at not less than 2/3 foot nor more than 1 foot per second.
      e. Heavy Duty
         1) Model GH - hoist
      f. Entrapment Protection: Required for momentary contact, includes radio control operation.
      g. Photoelectric sensors monitored to meet UL 325/2010.
      h. Operator Controls:
         1) Surface mounting.
         2) Both interior and exterior location.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until openings have been properly prepared.

B. Verify wall openings are ready to receive work and opening dimensions and tolerances are within specified limits.

C. Verify electric power is available and of correct characteristics.

D. If preparation is the responsibility of another installer, notify Engineer of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install overhead doors and track in accordance with approved shop drawings and the manufacturer's printed instructions.

B. Coordinate installation with adjacent work to ensure proper clearances and allow for maintenance.

C. Anchor assembly to wall construction and building framing without distortion or stress.

D. Securely brace door tracks suspended from structure. Secure tracks to structural members only.

E. Fit and align door assembly including hardware.

F. Coordinate installation of electrical service. Complete power and control wiring from disconnect to unit components.

G. Instruct Owner’s personnel in proper operating procedures and maintenance schedule.

3.04 ADJUSTING

A. Test for proper operation and adjust as necessary to provide proper operation without binding or distortion

B. Adjust hardware and operating assemblies for smooth and noiseless operation.

3.05 CLEANING

A. Clean doors, frames and glass using non-abrasive materials and methods recommended by manufacturer.

B. Remove labels and visible markings.

C. Touch-up, repair or replace damaged products before Substantial Completion.

3.06 PROTECTION

A. Do not permit construction traffic through overhead door openings after adjustment and cleaning.

B. Protect installed products until completion of project.

END OF SECTION

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SECTION 084112
ALUMINUM FRAMED ENTRANCES, STOREFRONTS AND WINDOWS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Section Includes: Kawneer Architectural Aluminum Storefront and Window Systems, including perimeter trims, stools, accessories, shims and anchors, and perimeter sealing of storefront units.

1.02 DEFINITIONS

A. Definitions: For fenestration industry standard terminology and definitions refer to American Architectural Manufacturers Association (AAMA) - AAMA Glossary (AAMA AG).

1.03 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials Current Edition.

B. AAMA 503 - Voluntary Specification for Field Testing of Newly Installed Storefronts, Curtain Walls and Sloped Glazing Systems 2014.

C. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test 2015.

D. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium 2017.

E. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel 2019.

F. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers 2005 (Reapproved 2019).

G. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.

H. ASTM C1036 - Standard Specification for Flat Glass 2021.

I. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass 2018.

J. ASTM C1184 - Standard Specification for Structural Silicone Sealants 2018, with Editorial Revision.

K. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass 2021.

L. ASTM E783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors 2002 (Reapproved 2018).

M. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference 2015.

N. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation 2010.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, hardware, finishes, and installation instructions for each type of aluminum-framed storefront system indicated.

C. Shop Drawings: Include plans, elevations, sections, details, hardware, and attachments to other work, operational clearances and installation details.

D. Samples for Initial Selection: For units with factory-applied color finishes including samples of hardware and accessories involving color selection.

E. Samples for Verification: For aluminum-framed storefront system and components required.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for each type of aluminum-framed storefront.

G. Fabrication Sample: Of each vertical-to-horizontal intersection of aluminum-framed systems, made from 12" (304.8 mm) lengths of full-size components and showing details of the following:
   1. Joinery.
   2. Anchorage.
   3. Expansion provisions.
   4. Glazing.
   5. Flashing and drainage.

H. Other Action Submittals:
   1. Entrance Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: An installer which has had successful experience with installation of the same or similar units required for the project and other projects of similar size and scope.

B. Manufacturer Qualifications: A manufacturer capable of providing aluminum-framed storefront system that meet or exceed performance requirements indicated and of documenting this performance by inclusion of test reports, and calculations.

C. Source Limitations: Obtain aluminum-framed storefront system through one source from a single manufacturer.

D. Product Options: Drawings indicate size, profiles, and dimensional requirements of aluminum-framed storefront system and are based on the specific system indicated. Refer to Division 01 Section “Product Requirements”. Do not modify size and dimensional requirements.
   1. Do not modify intended aesthetic effects, as judged solely by Engineer, except with Engineer's approval. If modifications are proposed, submit comprehensive explanatory data to Engineer for review.

1.06 MOCK-UPS

A. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Build mockup for type(s) of storefront elevation(s) indicated, in location(s) shown on Drawings.

1.07 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of aluminum-framed storefront openings by field measurements before fabrication and indicate field measurements on Shop Drawings.

1.08 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Manufacturer’s Warranty: Submit, for Owner’s acceptance, manufacturer’s standard warranty.
   1. Warranty Period: Two (2) years from Date of Substantial Completion of the project provided however that the Limited Warranty shall begin in no event later than six months from date of shipment by manufacturer.

PART 2 PRODUCTS

2.01 TRIFAB 451 ELEMENTS

A. (08.4112.01) Aluminum storefront, Kawneer non-thermal center glazed, 4-1/2".

B. (08.4112.11) Aluminum framed door; Kawner 350 entrance door, medium stile (350) for TriFab 451 / Trifab 451T aluminum framing system.

2.02 MANUFACTURERS

A. Basis-of-Design Product:

1. Kawneer Company Inc.; www.kawneer.com

B. Substitutions: See Section 016000 - Product Requirements.

2.03 MANUFACTURED UNITS

A. (08.4112.01) Aluminum storefront, Kawneer non-thermal center glazed, 4-1/2".
   1. Aluminum framed entrances, storefront, window; Kawneer Trifab VG 451 non-thermal center glazed framing system
      a. System Dimensions: 2" x 4-1/2" (50.8 mm x 114.3 mm)

B. (08.4112.04) Aluminum storefront; Kawneer thermal center glazed 4-1/2".
   1. Aluminum framed entrances, storefront, window; Kawneer Trifab VG 451T thermal center glazed framing system.
      a. System Dimensions: 2" x 4-1/2" (50.8 mm x 114.3 mm)

C. (08.4112.11) Aluminum framed door; Kawner 350 thermal entrance door, medium stile (350) for Trifab 451T aluminum framing system.

D. (08.4112.14) Aluminum framed door; Kawner 350 non-thermal entrance door, medium stile (350) for TriFab 451 aluminum framing system.

E. TriFab 451T (Thermal) and 451 (Non-thermal) Framing System.
   1. System Dimensions: 2" x 4-1/2" (50.8 mm x 114.3 mm)
   2. Glass: Center.

2.04 MATERIALS

A. Aluminum Extrusions: Alloy and temper recommended by aluminum storefront manufacturer for strength, corrosion resistance, and application of required finish and not less than 0.070" (1.8 mm) wall thickness at any location for the main frame and complying with ASTM B 221: 6063-T6 alloy and temper.

B. Fasteners: Aluminum, nonmagnetic stainless steel or other materials to be non-corrosive and compatible with aluminum framing members, trim hardware, anchors, and other components.

C. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.

D. Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.

E. Sealant: For sealants required within fabricated storefront system, provide permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement.

F. Tolerances: Reference to tolerances for wall thickness and other cross-sectional dimensions of storefront members are nominal and in compliance with AA Aluminum Standards and Data.

2.05 STOREFRONT AND WINDOW FRAMING SYSTEM

A. Thermal Barrier (Trifab™ VG 451T):
   1. Kawneer IsoLock™ Thermal Break with a 1/4" (6.4 mm) separation consisting of a two-part chemically curing, high-density polyurethane, which is mechanically and adhesively joined to aluminum storefront sections.
      a. Thermal Break shall be designed in accordance with AAMA TIR-A8 and tested in accordance with AAMA 505.

B. Non-Thermal (Trifab™ VG 451)

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

D. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials. Where exposes shall be stainless steel.

E. Perimeter Anchors: When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action

F. Packing, Shipping, Handling and Unloading: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

G. Storage and Protection: Store materials protected from exposure to harmful weather conditions. Handle storefront material and components to avoid damage. Protect storefront material against damage from elements, construction activities, and other hazards before, during and after storefront installation.

2.06 INSULATING-GLASS UNIT(S)

A. Double Glazed Clear Solar Control Insulating Glass Unit Solarban® 60 on Clear 6mm (2) Air (5%) / Argon (95%) Mix 1/2" (12.7mm) | Clear 6mm
   1. Conformance: ASTM E2190.
   2. Outdoor Lite: Clear Float Glass as manufactured by Vitro Architectural Glass
      a. Conformance: ASTM C1036, Type 1, Class 1, Quality q3.
      b. lass Thickness: 6mm (1/4")
      c. Magnetic Sputter Vacuum Deposition Coating (MSVD): ASTM C1376.
      d. Coating: Solarban® 60 on Surface # 2
      e. Heat-Treatment: Heat-strengthened, ASTM C1048, Kind HS; Safety Glazing meets ANSI Z97.1 and CPSC 16CFR-1201
      f. Tempered; ASTM C1048, Kind FT; Safety Glazing meets ANSI Z97.1 and CPSC 16 CFR 1201.
   3. Interspace Content: Air (5%) / Argon (95%) Mix 1/2" (12.7mm)
   4. Indoor Lite: Clear float glass as manufactured by Vitro Architectural Glass
      a. Conformance: ASTM C 1036, Type 1, Class 1, Quality q3.
      b. Heat-Treatment: [None] [Heat-strengthened, ASTM C1048, Kind HS] [Tempered; ASTM C1048, Kind FT; Safety Glazing meets ANSI Z97.1 and CPSC 16 CFR 1201]Specifier Notes: Specify the method of heat treatment. Vitro recommends that heat strengthened glass be specified and used, except where tempered glass is mandated for safety or other purposes by code.
      c. Glass Thickness: 6mm (1/4")
   5. Performance Requirements:
      a. Visible Light Transmittance: 70 percent minimum.
      b. Winter Nighttime U-Factor: 0.24 (Btu/hr*ft2*°F) maximum.
      c. Summer daytime U-Factor: 0.22 (Btu/hr*ft2*°F) maximum.
      d. Shading Coefficient: 0.44 maximum.
      e. Solar Heat Gain Coefficient: 0.39 maximum.
      f. Outdoor Visible Light Reflectance: 11 percent maximum.

B. Glazing Gaskets: Gaskets to meet the requirements of ASTM C864.

C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

D. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

E. Glazing Sealants: As recommended by manufacturer for joint type.

2.07 NON-INSULATED GLAZING SYSTEMS

A. Float Glass: Provide float glass based glazing unless noted otherwise.
   1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality-Q3.
   2. Heat-Strengthened and Fully Tempered Types: ASTM C1048, Kind HS and FT.
   3. Fully Tempered Safety Glass: Complies with ANSI Z97.1 and 16 CFR 1201 criteria.
   4. Impact Resistant Safety Glass: Complies with ANSI Z97.1 and 16 CFR 1201 criteria; Class B/Category I.
   5. Tinted Type: ASTM C1036, Class 2 - Tinted, Quality-Q3, color and performance characteristics as indicated.
   6. Patterned Glass Type: ASTM C1036, Type II - Patterned Flat Glass, Quality-Q5, Form 3 - Patterned glass, color and performance characteristics as indicated.
   7. Wired Glass Type: ASTM C1036, Type II - Wired Flat Glass, Quality-Q5, color and performance characteristics as indicated.

8. Safety Wired Glass Type: ASTM C1036, Type II - Wired Flat Glass, Quality-Q5, ANSI Z97.1 and 16 CFR 1201 impact criteria for Class B/Category I, and color and performance characteristics as indicated.
9. Thicknesses: As indicated; provide greater thickness as required for exterior glazing wind load design.

B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, extruded EPDM rubber.

C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

D. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

E. Glazing Sealants: For structural-sealant-glazed systems, as recommended by manufacturer for joint type, and as follows:
1. Structural Sealant: ASTM C1184, single-component neutral-curing silicone formulation that is compatible with system components with which it comes in contact, specifically formulated and tested for use as structural sealant and approved by a structural-sealant manufacturer for use in aluminum-framed systems indicated.
   a. Color: Black
2. Weatherseal Sealant: ASTM C920 for Type S, Grade NS, Class 25, Uses NT, G, A, and O; single-component neutral-curing formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and aluminum-framed-system manufacturers for this use.
   a. Color: Matching structural sealant.

2.08 ENTRANCE DOOR SYSTEMS

A. (08.4112.11) Aluminum framed door; Kawner 350 thermal entrance door, medium stile (350) for Trifab 451T aluminum framing system.

B. (08.4112.14) Aluminum framed door; Kawner 350 non-thermal entrance door, medium stile (350) for TriFab 451 aluminum framing system.

C. The door stile and rail face dimensions of the 190 entrance door will be as follows:

Model	Vertical Stile	Top Rail	Bottom Rail	Opt Bottom Rail
190	2-1/8"	2-1/4"	3-7/8"	10"
350	3-1/2"	3-1/2"	-----	10"
500	5"	5"	6-1/2"	10"

1. Major portions of the door members to be 0.125" (3.2) nominal in thickness and glazing molding to be 0.05" (1.3) thick.
2. Glazing gaskets shall be either EPDM elastomeric extrusions or a thermoplastic elastomer.
3. Provide adjustable glass jacks to help center the glass in the door opening.

D. The door stile and rail face dimensions of the 190 entrance door will be as follows:

Model	Vertical Stile	Top Rail	Bottom Rail	Opt Bottom Rail
190	2-1/8"	2-1/4"	3-7/8"	10"
350	3-1/2"	3-1/2"	-----	10"
500	5"	5"	6-1/2"	10"

1. Major portions of the door members to be 0.125" (3.2) nominal in thickness and glazing molding to be 0.05" (1.3) thick.
2. Glazing gaskets shall be either EPDM elastomeric extrusions or a thermoplastic elastomer.
3. Provide adjustable glass jacks to help center the glass in the door opening.

2.09 DOOR HARDWARE

A. General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, or other corrosion-resistant material compatible with aluminum; designed to smoothly operate, tightly close, and securely lock aluminum-framed entrance doors.

B. Standard Hardware:
   1. Weather-stripping:
      a. Meeting stiles on pairs of doors shall be equipped with an adjustable astragal utilizing wool pile with polymeric fin.
      b. The door weathering on a single acting offset pivot or butt hung door and frame (single or pairs) shall be comprised of a thermoplastic elastomer weathering on a tubular shape with a semi-rigid polymeric backing.
   2. Sill Sweep Strips: EPDM blade gasket sweep strip in an aluminum extrusion applied to the interior exposed surface of the bottom rail with concealed fasteners (Necessary to meet specified performance tests).
   3. Threshold: Extruded aluminum, one piece per door opening, with ribbed surface.
   4. Butt Hinge: Kawneer Standard is Stainless Steel w/ Powder Coating & Non Removable Pin (NRP) (NOTE: EL Hinge available for access control)
   5. Exit Device: Adams Rite MS+1890 Dead Latch with Adams Rite 4590 Latch paddle device.
   6. Architects Classic Hardware:
      a. Finish: #14 Clear Anodize
      b. Pull: Style CO-9
      c. Push bar: Style CP-II.
   7. Closer: LCN 4040XP painted to match #17 finish.

2.10 FABRICATION

A. Fabricate aluminum-framed entrance doors in sizes indicated. Include a complete system for assembling components and anchoring doors.

B. Fabricate aluminum-framed glass doors that are reglazable without dismantling perimeter framing.
   1. Door corner construction shall consist of mechanical clip fastening, SIGMA deep penetration plug welds and 1-1/8" (29 mm) long fillet welds inside and outside of all four corners. Glazing stops shall be hook-in type with EPDM glazing gaskets reinforced with non-stretchable cord.
   2. Accurately fit and secure joints and corners. Make joints hairline in appearance.
   3. Prepare components with internal reinforcement for door hardware.
   4. Arrange fasteners and attachments to conceal from view.

C. Weather-stripping: Provide weather-stripping locked into extruded grooves in door panels or frames as indicated on manufacturer's drawings and details.

2.11 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Factory Finishing:
   1. Kawneer Permanodic™ AA-M10C21A41 / AA-M45C22A41, AAMA 611, Architectural Class I Clear Anodic Coating; Color: #14 Clear.
   2. Other: Manufacturer: [_____];Type: [_____]; Color: [_____].

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work. Verify rough opening dimensions, levelness of sill plate and operational clearances. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weather tight framed aluminum storefront system installation.
   1. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.

2. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing aluminum-framed storefront system, accessories, and other components.

B. Install aluminum-framed storefront system level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.

C. Set sill members in bed of sealant or with gaskets, as indicated, for weather tight construction.

D. Install aluminum-framed storefront system and components to drain condensation, water penetrating joints, and moisture migrating within aluminum-framed storefront to the exterior.

E. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.03 FIELD QUALITY CONTROL

A. Field Tests: Engineer shall select storefront units to be tested as soon as a representative portion of the project has been installed, glazed, perimeter caulked and cured. Conduct tests for air infiltration and water penetration with manufacturer's representative present. Tests not meeting specified performance requirements and units having deficiencies shall be corrected as part of the contract amount.
   1. Testing: Testing shall be performed by a qualified independent testing agency. Refer to Testing Section for payment of testing and testing requirements. Testing Standard per AAMA 503, including reference to ASTM E783 for Air Infiltration Test and ASTM E1105 Water Infiltration Test.
      a. Air Infiltration Tests: Conduct tests in accordance with ASTM E783. Allowable air infiltration shall not exceed 1.5 times the amount indicated in the performance requirements or 0.09 cfm/ft2, whichever is greater.
      b. Water Infiltration Tests: Conduct tests in accordance with ASTM E1105. No uncontrolled water leakage is permitted when tested at a static test pressure of two-thirds the specified water penetration pressure but not less than 6.2 psf (300 Pa).

B. Manufacturer's Field Services: Upon Owner’s written request, provide periodic site visit by manufacturer’s field service representative.

3.04 ADJUSTING, CLEANING, AND PROTECTION

A. Clean aluminum surfaces immediately after installing aluminum-framed storefronts. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

B. Clean glass immediately after installation. Comply with glass manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.

C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION

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SECTION 087100
DOOR HARDWARE

PART 1 GENERAL

1.01 SUMMARY

A. Section includes furnishing and installation of mechanical door hardware for doors specified in “Hardware Sets” and required by actual conditions: including screws, bolts, and expansion shields for proper application of hardware.

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

C. Related Divisions:
   1. Division 08 Openings

1.02 REFERENCES

A. American National Standards Institute/Builders Hardware Manufacturers Association (ANSI):
   1. ANSI/BHMA A156.1 Butts & Hinges (2016)
   2. ANSI/BHMA A156.2 Bored & Preassembled Locks & Latches (2011)
   3. ANSI/BHMA A156.3 Exit Devices (2014)
   4. ANSI/BHMA A156.4 Door Controls - Closers (2013)
   5. ANSI/BHMA A156.5 Cylinders and Input Devices for Locks (2014)
   6. ANSI/BHMA A156.6 Architectural Door Trim (2015)
   7. ANSI/BHMA A156.7 Template Hinge Dimensions (2016)
   8. ANSI/BHMA A156.8 Door Controls - Overhead Stops and Holders (2015)
   9. ANSI/BHMA A156.16 Auxiliary Hardware (2013)
   10. ANSI/BHMA A156.18 Materials & Finishes (2016)
   11. ANSI/BHMA A156.21 Thresholds (2014)
   12. ANSI/BHMA A156.22 Door Gasketing Systems (2012)
   13. ANSI/BHMA A156.26 Continuous Hinges (2012)
   14. ANSI/BHMA A156.28 Keying Systems (2013)
   15. ANSI/BHMA A156.115 Hardware Preparation in Steel Doors and Steel Frames (2014)
   16. ANSI/BHMA A156.115W Hardware Preparation in Wood Doors with Wood or Steel Frames (2016)

B. International Code Council/American National Standards Institute (ICC/ANSI)/ADA:
   1. ICC/ANSI A117.1 Standards for Accessible and Usable Buildings and Facilities 2009.

C. Underwriters Laboratories, Inc. (UL):
   1. UL 10C Positive Pressure Fire Test of Door Assemblies.
   2. UL 1784 Air Leakage Test of Door Assemblies.
   3. UL 294 Access Control System Units

D. Door and Hardware Institute (DHI):
   1. DHI Publications - Keying Systems and Nomenclature (1989).
   2. DHI Publication - Abbreviations and Symbols.
   3. DHI Publication - Installation Guide for Doors and Hardware.
   4. DHI Publication - Sequence and Format of Hardware Schedule (1996).

E. National Fire Protection Agency (NFPA):
   1. NFPA 70 National Electrical Code 2011.
   2. NFPA 80 Standard for Fire Doors and Other Opening Protectives 2013.
   3. NFPA 101 Life Safety Code 2012.
   4. NFPA 105 Standard for the Installation of Smoke Door Assemblies 2013.

1.03 SUBMITTALS

A. Submit in accordance with Conditions of the Contract and Division 1 Administrative Requirements and Submittal Procedures Section.

B. Shop Drawings:
   1. Organize hardware schedule in vertical format as illustrated in DHI Publications Sequence and Formatting for the Hardware Schedule. Include abbreviations and

symbols page according to DHI Publications Abbreviations and Symbols. Complete nomenclature of items required for each door opening as indicated.

2. Coordinate final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of hardware.
3. Architectural Hardware Consultant (AHC), as certified by DHI, who will affix seal attesting to completeness and correctness, including the review of the hardware schedule prior to submittal.

C. Submit manufacturer's catalog sheet on design, grade, and function of items listed in hardware schedule. Identify specific hardware item per sheet, provide an index, and cover sheet.

D. Coordination:
1. Upon final approval of the architectural hardware schedules, submit one set of complete templates for each hardware item to the door manufacturers, frame manufacturers, and the installers. Date and index these 8-1/2 inch x 11 inch papers in a three ring binder, including detailed lists of the hardware location requirements for mortised and surface applied hardware within fourteen days of receiving approved door hardware submittals.

E. Closeout Submittals: Submit to Owner in a three-ring binder or CD if requested.
1. Warranties.
2. Maintenance and operating manual.
3. Maintenance service agreement.
4. Record documents.
5. Copy of approved hardware schedule.
6. Copy of approved keying schedule with bitting list.
7. Door hardware supplier name, phone number, and fax number.

1.04 QUALITY ASSURANCE

A. Listed and Labeled electrified door hardware as defined in NFPA 70, Article 100, by a testing agency acceptable to authority having jurisdiction.

B. Hardware supplier will employ an Architectural Hardware Consultant (AHC) as certified by DHI and a member of the seal program who will be available at reasonable times during course of work for Project hardware consultation.

C. Door hardware conforming to ICC/ANSI A117.1: Handles pulls, latches locks and operating devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.

D. Fired Rated Door Assemblies: Where fire-rated door assemblies are indicated, provide door hardware rated for use in assemblies complying with NFPA 80 that are listed and/or labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to UL 10C, unless otherwise indicated.

E. Fire Door Inspection: Prior to receiving certificate of occupancy have fire rated doors inspected by an independent Certified Fire and Egress Door Assembly Inspector (FDAI), as certified by Intertek (ITS), a written report be submitted to Owner and Contractor. Doors failing inspection must be adjusted, replaced or modified to be within appropriate code requirements.

F. Smoke and Draft Control Door Assemblies: Where smoke and draft control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.

G. Door hardware certified to ANSI/BHMA standards as noted, participate and be listed in BHMA Certified Products Directory.

H. Substitution request:
1. Create a comparison chart that includes the testing information as well as the warranty for both the specified product and the proposed substitution. Include the reason for requesting the substitution, clear catalog copy highlighting the proposed product and options, compliance statement, technical data, product warranty and lead time, to show how the proposed can meet or exceed established level of design, function, and

quality. Approval of request is at the discretion of the Owner, Engineer, and their designated consultants and will be addressed via addendum prior to bid date.

I. Meetings: Comply with requirements in Division 1 Section “Project Meetings.”
   1. Keying Meeting
      a. Within fourteen days of receipt of approved door hardware submittals, contact Owner with representative from hardware supplier to establish a keying conference. Verify keyway, visual key identification, number of master keys and keys per lock. Provide keying system per Owner’s instructions.

J. Installer Qualifications: Specialized in performing installation of this Section and have five years minimum documented experience.

K. Hardware listed in 3.07 - Hardware Schedule is intended to establish minimum level of design, type, function and grade.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Provide clean, dry and secure room for hardware delivered to Project but not yet installed. Shelve hardware off of the floor. Large items of hardware shall be stored on wooden pallets. Arrange locksets and keyed cylinders by opening number. Organize the balance of hardware by brand, model of hardware, and hardware set number. Leave the door markings of the hardware visible for installers.

B. Furnish hardware with each unit marked and numbered in accordance with approved finish hardware schedule. Include architect’s opening number, hardware set number, and item number for each type of hardware. Include keyset symbols and corresponding hardware component for keyed products.

C. Pack each item complete with necessary parts and fasteners in manufacturer’s original packaging.

D. Deliver architectural hardware to the job site according to the phasing agreed upon in the pre-installation meeting. Inventory the delivery with the supplier’s assistance. Immediately note shortages and damages on the shipping receipts and bill of ladings. Coordinate replacement or repair with the supplier.

E. Deliver permanent keys, cores, access control credentials, software, and related accessories directly to Owner via registered mail or overnight package service. Establish the instructions for delivery to Owner at “Keying Conference.”

F. Waste Management and Disposal: Separate waste materials for use or recycling in accordance with Division 1.

1.06 WARRANTY

A. General Warranty: Owner may have under provisions of the Contract Documents and be an addition and run concurrently with other warranties made by Contractor under requirements of the Contract documents.

B. Special Warranty: Warranties specified in this article will not deprive Owner of other rights.
   1. Ten years for manual door closers.
   2. Five years for mortise, auxiliary and bored locks.
   3. Five years for exit devices.

C. Replace or repair defective products during warranty period in accordance with manufacturer’s warranty at no cost to Owner. There is no warranty against defects due to improper installation, abuse, and failure to exercise normal maintenance.

D. Maintenance Tool and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner’s continued adjustment, maintenance, removal and replacement of door hardware.

PART 2 PRODUCTS

2.01 HINGES

A. Hinges, electric hinges, and self-closing hinges of one manufacturer as listed for continuity of design and consideration of warranty.

B. Standards: Products to be certified and listed by the following:
   1. Butts and Hinges: ANSI/BHMA A156.1.

2. Template Hinge Dimensions: ANSI/BHMA A156.7.
3. Self-Closing Hinges: ANSI/BHMA A156.17.

C. Butt Hinges:
1. Hinge weight and size unless otherwise indicated in hardware sets:
   a. Doors up to 36” wide and up to 1-3/4” thick provide hinges with a minimum thickness of .134” and a minimum of 4-1/2” in height.
   b. Doors from 36” wide up to 42” wide and up to 1-3/4” thick provide hinges with a minimum thickness of .145” and a minimum of 4-1/2” in height.
   c. For doors from 42” wide up to 48” wide and up to 1-3/4” thick provide hinges with a minimum thickness of .180” and a minimum of 5” in height.
   d. Doors greater than 1-3/4” thick provide hinges with a minimum thickness of .180” and a minimum of 5” in height.
   e. Width of hinge is to be minimum required to clear surrounding trim.
2. Base material unless otherwise indicated in hardware sets:
   a. Exterior Doors: 304 Stainless Steel, Brass or Bronze material.
   b. Interior Doors: Steel material.
   c. Fire Rated Doors: Steel or 304 Stainless Steel materials.
   d. Stainless Steel ball bearing hinges to have stainless steel ball bearings. Steel ball bearings are unacceptable.
3. Quantity of hinges per door unless otherwise stated in hardware sets:
   a. Doors up to 60” in height provide 2 hinges.
   b. Doors 60” up to 90” in height provide 3 hinges.
   c. Doors 90” up to 120” in height provide 4 hinges.
   d. Doors over 120” in height add 1 additional hinge per each additional 30” in height.
   e. Dutch doors provide 4 hinges.
4. Hinge design and options unless otherwise indicated in hardware sets:
   a. Hinges are to be of a square corner five-knuckle design, flat button tips and have ball bearings unless otherwise indicated in hardware sets.
   b. Out-swinging exterior and out-swinging access controlled doors are required to have Non-Removable Pins (NRP) to prevent removal of pin while door is in closed position.
   c. When full width of opening is required, use hinges that are designed to swing door completely from opening when door is opened to 95 degrees.
   d. When shims are necessary to correct frame or door irregularities, provide metal shims only.

D. Acceptable Manufacturers:

	Standard Weight	Heavy Weight
Hager	BB1279/BB1191	BB1199
Bommer	BB5000/BB5002	BB5006
McKinney	TA2714/TA2314	T4A3386

2.02 CONTINUOUS HINGES

A. Continuous hinges of one manufacturer as listed for continuity of design and consideration of warranty.

B. Standards: Products to be certified and listed by the following: Continuous Hinges: ANSI/BHMA A156.26 Grade 1.

C. Continuous Geared Hinges:
1. Determine model number by door and frame application, door thickness, frequency of use, and fire rating requirements according to manufacturer’s recommendations.
   a. Size length of hinge to be 1” less then nominal door height unless otherwise stated in hardware sets.

D. Material and Design:
1. Base material: Anodized aluminum manufactured from 6063-T6 material, unexposed working metal surfaces be coated with TFE dry lubricant.
2. Bearings:
   a. Vertical loads be carried on Lubriloy RL bearings for non-fire rated doors.

b. Continuous hinges are to have a minimum spacing between bearings of 2-9/16”. Typical door from 80” to 84” in height to have a minimum of 32 bearings.

3. Options:
   a. When full width of opening is required, use hinges that are designed to swing door completely from opening when door is opened to 95 degrees.
   b. At fire rated openings provide hinges that carry a UL certification, up to and including 90-minute applications for wood doors and up to 3-hour applications for metal doors.

E. Acceptable Manufacturers:

	Heavy Duty
Hager	780-224HD
Bommer	FMHD
Zero	914A

2.03 FLUSH BOLTS

A. Flush bolts of one manufacturer as listed for continuity of design and consideration of warranty.

B. Standards: Manufacturer to be listed by the following: Auxiliary Hardware: ANSI/BHMI A156.16.

C. Labeled openings: Provide automatic or constant latching flush bolts per hardware schedule for inactive leaf of pairs of doors. Provide dust proof strikes for bottom bolt.

D. Non-Labeled openings: Provide two flush bolts for inactive leaf of pairs of doors per hardware schedule. Provide extension rods so that the center line of the top flush bolt is not more than 78” above the finish floor. Provide dust proof strike from bottom bolt.

E. Acceptable Manufacturers:

	Manual Flush Bolt	Dust Proof Strike
Hager	282D	280X
Rockwood	555	570
Trimco	3917	3911

2.04 LOCKS AND LATCHES

A. Locks and latches of one manufacturer as listed for continuity of design and consideration of warranty.

B. Standards: Product to be certified and listed by following:
   1. ANSI/BHMA A156.2 Series 4000 Certified to Grade 1.
   2. UL/cUL Labeled and listed for functions up to 3 hours for single doors up to 48” in width and up to 96” in height.
   3. UL10C/UBC 7-2 Positive Pressure Rated.
   4. ICC/ANSI A1117.1

C. Lock and latch function numbers and descriptions of manufacturer’s series as listed in hardware sets.

D. Material and Design:
   1. Lock and latch chassis to be zinc dichromate for corrosion resistance.
   2. Keyed functions to be of a freewheeling design to help resist against vandalism.
   3. Non-handed, field reversible.
   4. Thru-bolt mounting with no exposed screws.
   5. Levers, zinc cast and plated to match finished designation in hardware sets.
   6. Roses, wrought brass or stainless steel material.

E. Latch and Strike:
   1. Stainless Steel latch bolt with minimum of 1/2” throw and deadlocking for keyed and exterior functions. Provide 3/4” latch bolt for pairs of fire-rated doors where required by door manufacturer. Standard backset to be 2-3/4” and adjustable faceplate to accommodate a square edge door or a standard 1/8” beveled edge door.

2. Strike is to fit a standard ANSI A115 prep measuring 1-1/4” x 4-7/8” with proper lip length to protect surrounding trim.

F. Acceptable manufacturers:

Hager	3400 Series
Schlage	ND Series
Best	9K Series

2.05 EXIT DEVICES

A. Exit Devices of one manufacturer as listed for continuity of design and consideration of warranty. Touchpad type, finish to match balance of door hardware.

B. Standards: Manufacturer to be certified and/or listed by the following:
1. BHMA Certified ANSI/BHMA A156.30 Grade 1.
2. UL/cUL Listed for up to 3 hours for “A” labeled doors.
3. UL10C/UBC 7-2 Positive Pressure Rated.
4. UL10B Neutral Pressure Rated.
5. UL 305 Listed for Panic Hardware.
6. 2007 Florida Building Code Certification Number: FL9481.1.
7. ANSI/BHMA A250.13 Severe Windstorm Resistant Component.

C. Material and Design:
1. Provide exit devices with actuators that extend a minimum of one-half of door width.
2. Where trim is indicated in hardware sets provide the lever design to match design of lock levers.
3. Exit device to mount flush with door.
4. Latchbolts:
   a. Rim device - 3/4” throw, Pullman type with automatic dead-latching, stainless steel
   b. Surface vertical rod device - Top 1/2” throw, Pullman type with automatic dead-latching, stainless steel. Bottom 1/2” throw, Pullman type, held retracted during door swing, stainless steel.
5. Fasteners: Wood screws, machine screws, and thru-bolts.

D. Lock and Latch Functions: Function numbers and descriptions of manufacturer’s series and lever styles indicated in door hardware sets.

E. Acceptable Manufactures:

Hager	4500 Series
Von Duprin	98 Series
Sargent	80 Series

2.06 CYLINDERS AND KEYING

A. Cylinders of one manufacturer as listed for continuity of design and consideration of warranty.

B. Products to be certified and listed by the following:
1. Auxiliary Locks: ANSI/BHMA A156.5
2. DHI Handbook “Keying systems and nomenclature” (1989)

C. Cylinders:
1. Manufacturer’s standard tumbler type, seven-pin conventional core supported by the Hager H1 keyway.
2. Furnish with cams/tailpieces as required for locking device that is being furnished for project.

D. Keying:
1. Copy of Owners approved keying schedule submitted to Owner and Engineer with documentation of which keying conference was held and Owner’s sign-off.
2. Provide a bitting list to Owner of combinations as established and expand to twenty-five percent for future use or as directed by Owner.
3. Keys to be shipped to Owner’s Representative, individually tag per keying conference.
4. Provide visual key control identification on keys.

E. Acceptable Manufacturers:

Hager
Schlage
Sargent

2.07 PUSH PLATES & DOOR PULLS

A. Push plates and door pulls of one manufacturer as listed for continuity of design and consideration of warranty.

B. Standards: Manufacturer to be certified by the following:
   1. Architectural Door Trim: ANSI/BHMA A156.6.
   2. Americans with Disabilities Act Accessibility Guidelines (ADAAG).

C. Push plates: 050” thick, square corner and beveled edges with countersunk screw holes. Width and height as stated in hardware sets.

D. Acceptable Manufacturers:

Hager	30S
Rockwood	
Trimco	

E. Pull Plates: 050” thick, square corner and beveled edges. Width and height as stated in hardware sets, 3/4” diameter pull, with clearance of 2-1/2” from face of door.

F. Acceptable Manufacturers:

Hager	H33J
Rockwood	
Trimco	

2.08 HEAVY-DUTY DOOR CLOSERS

A. Closers of one manufacturer as listed for continuity of design and consideration of warranty, unless otherwise indicated on hardware schedule, comply with manufacturer’s recommendations for size of closer, depending on width of door, frequency of use, atmospheric pressure, ADAAG requirement, and fire rating.

B. Standards: Manufacturer to be certified and or listed by the following:
   1. BHMA Certified ANSI A156.4 Grade 1.
   2. ADA Complaint ANSI A117.1.
   3. UL/cUL Listed up to 3 hours.
   4. UL10C Positive Pressure Rated.
   5. UL10B Neutral Pressure Rated.

C. Material and Design:
   1. Provide cast iron non-handed bodies with full plastic covers.
   2. Closers will have separated staked adjustable valve screws for latch speed, sweep speed, and backcheck.
   3. Provide Tri-Pack arms and brackets for regular arm, top jamb, and parallel arm mounting.
   4. One-piece seamless steel spring tube sealed in hydraulic fluid.
   5. Double heat-treated steel tempered springs.
   6. Precision-machined heat-treated steel piston.
   7. Triple heat-treated steel spindle.
   8. Full rack and pinion operation.

D. Mounting:
   1. Out-swing doors use surface parallel arm mount closers except where noted on hardware schedule.
   2. In-swing doors use surface regular arm mount closers except where noted on hardware schedule.
   3. Provide brackets and shoe supports for aluminum doors and frames to mount fifth screw.

4. Furnish drop plates where top rail conditions on door do not allow for mounting of closer and where backside of closer is exposed through glass.

E. Size closers in compliance with requirements for accessibility (ADAAG). Comply with following maximum opening force requirements.
1. Interior hinged openings: 5.0 lbs.
2. Fire-rated and exterior openings use minimum opening force allowable by authority having jurisdiction.

F. Fasteners: Provide self-reaming, self-tapping wood and machine screws, and sex nuts and bolts for each closer.

G. Acceptable manufacturers:

Hager	5100 Series
LCN	4040XP Series
Sargent	281 Series

2.09 STAINLESS STEEL DOOR CLOSERS

A. Closers of one manufacturer as listed for continuity of design and consideration of warranty. Unless otherwise indicated on hardware schedule, comply with manufacturer's recommendations for size of closer, depending on width of door, frequency of use, atmospheric pressure, ADAAG requirements, and fire rating.

B. Standards: Manufacturer to be certified by the following:
1. BHMA Certified ANSI A156.4 Grade 1.
2. ADA Complaint ANSI A117.1.
3. UL/cUL Listed up to 3 hours.
4. UL10C Positive Pressure Rated.
5. UL10B Neutral Pressure Rated.

C. Material and Design:
1. Provide stainless steel non-handed bodies.
2. Closers will have separate staked adjustable valve screws for latch speed, sweep speed, and backcheck.
3. Provide Tri-Pack arms and brackets for regular arm, top jamb, and parallel arm mounting.
4. Double heat-treated steel, tempered springs.
5. Precision machined heat-treated steel piston.
6. Triple heat-treated steel spindle.
7. Full rack and pinion operation.

D. Mounting:
1. Out-swing doors surface parallel arm mount closers except where noted on hardware schedule.
2. In-swing doors surface regular arm mount closers except where noted on hardware schedule.
3. Provide brackets and shoe supports for aluminum doors and frames to mount fifth screw.
4. Furnish drop plates where top rail conditions on door do not allow for mounting of closer and where backside of closer is exposed through glass.

E. Size closers in compliance with requirements for accessibility (ADAAG). Comply with following maximum opening force requirements.
1. Interior hinged openings: 5.0 lbs.
2. Fire-rated and exterior openings are to be adjusted to have minimum opening force allowable by authority having jurisdiction.

F. Fasteners: Provide self-reaming, self-tapping wood and machine screws, and sex nuts and bolts for each closer.

G. Acceptable manufacturers:

Norton	1600SS Series
Approved Equal	

2.10 PROTECTIVE TRIM

A. Protective trim of one manufacturer as listed for continuity of design and consideration of warranty.

B. Size of protection plate: single doors, size two inches less door width (LDW) on push side of door, and one inch less door width on pull side of door. For pairs of doors, size one inch less door width (LDW) on push side of door, and 1/2 inch on pull side of door. Adjust sizes to accommodate accompanying hardware, such as, edge guards, astragals and others.
   1. Kick Plates 10” high or sized to door bottom rail height.
   2. Mop Plates 4” high.
   3. Armor Plates 36” high.

C. Products to be certified and listed by the following:
   1. Architectural Door Trim: ANSI/BHMA A156.6.
   2. UL.

D. Material and Design:
   1. 0.050” gage stainless steel.
   2. Corners square, polishing lines or dominant direction of surface pattern so they run across door width of plate.
   3. Bevel top, bottom, and sides uniformly leaving no sharp edges.
   4. Countersink holes for screws. Space screw holes so they are no more than eight inches CTC, along a centerline not over 1/2” in from edge around plate. End screws maximum of 0.53” from corners.

E. UL label stamp required on protection plates when top of plate is more than 16 inches above bottom of door on fire rated openings. Verify door manufacturer’s UL listing for maximum height and width of protection plate to be used.

F. Acceptable Manufacturers:

Hager	190S
Trimco	
Burns	

2.11 STOPS AND HOLDERS

A. Stops and holders of one manufacturer as listed for continuity of design and consideration of warranty.

B. Wall Stops: Provide door stops wherever necessary to prevent door or hardware from striking an adjacent partition or obstruction. Provide wall stops when possible. Door stops and holders mounted in concrete floor or masonry walls have stainless steel machine screws and lead expansion shields.

C. Products to be certified and listed by the following:
   1. Auxiliary Hardware: ANSI/BHMA A156.16.

D. Acceptable Manufacturers:

	Convex	Concave
Hager	232W	236W
Rockwood		
Burns		

E. Overhead Stops and Holders: Provide overhead stops and holders for doors that open against equipment, casework sidelights and other objects that would make wall stops/holders and floor stops/holders inappropriate. Provide sex bolt attachments for mineral core wood door applications.

F. Products to be certified and listed by the following:
   1. Overhead Stops and Holders: ANSI/BHMA A156.8 Grade 1.

G. Acceptable Manufacturers:

	Heavy Duty Surface	Heavy Duty Concealed
Hager	7000 SRF Series	7000 CON Series

Glynn Johnson	90 SRF Series	100 Series
Sargent	590 Series	690 Series

2.12 THRESHOLDS

A. Thresholds of one manufacturer as listed for continuity of design and consideration of warranty.

B. Set thresholds for exterior and acoustical openings in full bed of sealant with lead expansion shields and stainless steel machine screws complying with requirements specified in Division 7 Section “Joint Sealants: Notched in field to fit frame by hardware installer. Refer to Drawings for special details.

C. Standards: Manufacturer to be certified by the following:
   1. Thresholds: ANSI/BHMA A156.21.
   2. American with Disabilities Act Accessibility Guidelines (ADAAG).

D. Acceptable Manufacturers:

Hager	413S
K.N. Crowder	
Reese	

2.13 DOOR GASKETING AND WEATHERSTRIP

A. Door gasketing and weatherstrip of one manufacturer as listed for continuity of design and consideration of warranty.

B. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing where indicated on hardware schedule. Provide noncorrosive fasteners for exterior applications.
   1. Perimeter gasketing: Apply to head and jamb, forming seal between door and frame.
   2. Meeting stile gasketing: Fasten to meeting stiles, forming seal when doors are in closed position.
   3. Door buttons: Apply to bottom of door, forming seal with threshold or floor when door is in closed position.
   4. Sound Gasketing: Cutting or notching for stop mounted hardware not permitted.
   5. Drip Guard: Apply to exterior face of frame header. Lip length to extend 4” beyond width of door.

C. Products to be certified and listed by the following:
   1. Door Gasketing and Edge Seal Systems: ANSI/BHMA A156.22.
   2. BHMA certified for door sweeps, automatic door bottoms, and adhesive applied gasketing.

D. Smoke-Labeled Gasketing: Comply with NFPA 105 listed, labeled, and acceptable to Authorities Having Jurisdiction, for smoke control indicated.
   1. Provide smoke-labeled gasketing on 20 minute rated doors and on smoke rated doors.

E. Fire-Rated Gasketing: Comply with NFPA 80 listed, labeled, and acceptable to Authorities Having Jurisdiction, for fire ratings indicated.

F. Refer to Section 08 1416 Wood Doors for Category A or Category B. Comply with UBC 7-2 and UL10C positive pressure where frame applied intumescent seals are required.

G. Acceptable Manufacturers:
   1. Perimeter Gasketing:

	Stop Applied
Hager	881SS
K.N. Crowder	
Reese	

   2. Overlapping Astragal:

Hager	837SS
K.N. Crowder	

Reese	

3. Door Bottom Sweeps:

Hager	750SS
K.N. Crowder	
Reese	

4. Overhead Drip Guard

Hager	810S
K.N. Crowder	
Reese	

2.14 LATCH PROTECTORS

A. Latch protectors of one manufacturer as listed for continuity of design and consideration of warranty.

B. Standards: Manufacturer to be listed by the following: Auxiliary Hardware: ANSI/BHMA A156.16.

C. Design:
1. 12 ga. steel, stainless steel material.
2. Size: 3” x 11”.
3. Non-handed.
4. Frame pin prevents prying of door.
5. Use with 1-3/4” thick door.
6. Use with cylindrical locksets with a 2-3/4” backset.
7. Fasteners: Two 5/16-20 x 1-1/2” carriage bolts with sex nuts.

D. Acceptable Manufacturers:

Hager	341D
Rockwood	
Trimco	

2.15 SILENCERS

A. Where smoke, light, or weather seal are not required, provide three silencers per single door frame, two per double door frame and four per Dutch door frame.

B. Products to be certified and listed by the following:
1. Auxiliary Hardware: ANSI/BHMA A156.16

C. Acceptable Manufacturers:

	Hollow Metal Frame
Hager	307D
Rockwood	
Trimco	

2.16 SIGNAGE

A. Signage of one manufacturer as listed for continuity of design and consideration of warranty.

B. Products to be certified and listed by the following:
1. Signage: ANSI/BHMA A156.16
2. Grade 2 Braille Translation conforming to Section 4.3 requirements.

C. Materials and Design: Provide 0.125” thick plastic. Size of sign to be 6” x 8” fastened with double-sided pressure-sensitive tape.

D. Acceptable Manufacturers:

Hager	368M/W, 368U
Rockwood	

Trimco	

2.17 FINISHES

A. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if within range of approved samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within range of approved samples.

B. Comply with base material and finish requirements indicated by ANSI/BHMA A156.18 designations in hardware schedule.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine doors and frames, with Installers present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.

3.02 INSTALLATION

A. Install hardware using manufactures recommended fasteners and installation instructions, at height locations and clearance tolerances that comply with:
   1. NFPA 80
   2. NFPA 105
   3. ICC/ANSI A117.1
   4. DHI Publication - Installation Guide for Doors and Hardware
   5. Approved shop drawings
   6. Approved finish hardware schedule

B. Install soffit mounted gaskets prior other soffit mounted hardware to provide a continuous seal around the perimeter of the opening without cutting or notching.

C. Install door closers so they are on the interior of the room side of the door. Stairwell doors will have closers mounted on the stair side and exterior doors will be mounted on the interior side of the building.

D. In drywall applications provide blocking material of sufficient type and size for hardware items that mount directly to the wall.

E. Locate wall mounted bumper to contact the trim of the operating trim.

F. Mount mop and kick plates flush with the bottom of the door and centered horizontally on the door.

G. Set thresholds for exterior, and acoustical doors at sound control openings in full bed of sealant complying with requirements specified in Division 07 Section “Joint Sealants” forming a tight seal between threshold and surface to which set.

H. Anchor all components firmly into position and use anchoring devices furnished with the hardware item, unless otherwise specified.

I. Do not install surface mounted items until finishes have been completed on substrates involved. Set unit level, plumb and true to line location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.

3.03 FIELD QUALITY CONTROL

A. Material supplier to schedule final walk through to inspect hardware installation ten (10) business days before final acceptance of Owner. Material supplier will provide a written report detailing discrepancies of each opening to General Contractor within seven (7) calendar days of walk through.

3.04 ADJUSTMENT, CLEANING, AND DEMONSTRATING

A. Adjustment: Adjust and check each opening to ensure proper operation of each item of finish hardware. Replace items that cannot be adjusted to operate freely and smoothly or as intended for application at no cost to Owner.

B. Cleaning: Clean adjacent surfaces soiled by hardware installation. Clean finish hardware per manufacturer's instructions after final adjustments have been made. Replace items that cannot be cleaned to manufacturer's level of finish quality at no cost to Owner.

C. Conduct a training class for building maintenance personnel demonstrating the adjustment, operation of mechanical and electrical hardware. Special tools for finish hardware to be turned over and explained usage at the meeting.

3.05 PROTECTION

A. Leave manufacturer's protective film intact and provide proper protection for all other finish hardware items that do not have protective material from the manufacture until Owner accepts project as complete.

3.06 HARDWARE SET SCHEDULE

A. Intent of Hardware Groups
   1. Should items of hardware not specified be required for completion of the Work, furnish such items of type and quality comparable to adjacent hardware and appropriate for service required.
   2. Where items of hardware aren't correctly specified and are required for completion of the Work, a written statement of such omission, error, or other discrepancy is required to be submitted to Engineer, prior to date specified for receipt of bids for clarification by addendum; or furnish such items in the type and quality established by this specification, and appropriate to the service intended.

B. Guide: Door hardware items have been placed in sets which are intended to be a guide of design, grade, quality, function, operation, performance, exposure, and like characteristics of door hardware, and may not be complete. Provide door hardware required to make each set complete and operational.

C. Hardware schedule does not reflect handing, backset, method of fastening, and like characteristics of door hardware and door operation.

D. Review door hardware sets with door types, frames, sizes and details on drawings. Verify suitability and adaptability of items specified in relation to details and surrounding conditions.

3.07 HARDWARE SCHEDULE

A. **Doors:**

Dr#	Room	#	to	Room	#	Set
100	Compressor Room	111	-	Exterior	-	03
101	Parts & Tool Storage	112	-	Corridor	110	04
102	Compressor Room	111	-	Corridor	116	05
103	Waiting Area	100	-	Corridor	116	06
104	Waiting Area	100	-	Closet	108	05
105	Waiting Area	100	-	Corridor	103	06
106	Sprinkler Room	102	-	Exterior	-	03
107	Electrical Room	113	-	Corridor	103	10
108	Area 6	169	-	Exterior	-	02
109	Sprinkler Room	190	-	Exterior	-	02
110	Area 5 Storage	167	-	Exterior	-	02
111	Unisex Toilet	114	-	Corridor	103	07
112	Area 4 Commingled Tipping	168	-	Exterior	-	02
113	Area 4 Commingled Tipping	168	-	Exterior	-	02
114	Area 1 Existing Tipping	-	-	Exterior	-	02
115	Area 1 Existing Tipping	-	-	Exterior	-	02
116	Corridor	116	-	Corridor	110	06
117	Not Used					
118	Area 5	167	-	Existing Tipping	-	11
200	Conference Room	200	-	Coffee / Copy Area	204	06

201	Office	205	-	Coffee / Copy Area	204	06
202	Coffee / Copy Area	204	-	Janitor Closet	206	05
203	Unisex Toilet	207	-	Coffee / Copy Area	204	07
204	H.C. Unisex Toilet	208	-	Coffee / Copy Area	204	07
205	Rockland Green Room	209	-	Coffee / Copy Area	204	06
206	Elevator Lobby	-	-	Coffee / Copy Area	204	06
207	Storage	211	-	Elevator Lobby	-	04
208	I.T. Closet	210	-	Elevator Lobby	-	06
500	Employee Break Room	101	-	Exterior	-	08
600	Conference Room	200	-	Elevator Lobby	-	09

B. **SET #01**
1. Doors: 001, 002, 003, 004, 005, 006, 007, 008, 009, 010, 011, 012, 013, 014, 015
2. NOTE: Hardware by overhead door manufacturer.

C. **SET #02**
1. Doors: 108, 109, 110, 112, 113, 114, 115

3	Hinges	BB1279 4 1/2 x 4 1/2 NRP	US26D	HA
1	Entrance Lock	3453 ARC	US26D	HA
1	Closer	5100 HDHOCS	ALM	HA
1	Kick Plate	190S 10" x 2" LDW CSK	US32D	HA
1	Threshold	413S x LAR	MIL	HA
1	Door Bottom Sweep	750SS x LAR	CLR	HA
1	Set Weatherstrip	881SS x LAR	MIL	HA
1	Drip Cap	810S x LAR	MIL	HA

2. NOTE: Install 881S weatherstripping before door closer.

D. **SET #03**
1. Door #100, 106

8	Hinges	BB1191 5x 4 1/2 NRP	US32D	HA
1	Set Automatic flush bolts	292D	US32D	HA
1	Dust proof strike	280X	US32D	HA
1	Entrance Lockset	3453 ARC	US32D	HA
1	Coordinator	297D x LAR	BLACK	HA
2	Kick Plate	190S 10" x 1" LDW	US32D	HA
2	Closers	5100 HDHOCS	AL	HA
1	Set Weatherstrip	881SS x LAR	MIL	HA
1	Astragal	By door manufacturer		
1	Threshold	413S x LAR	MIL	HA
2	Door Bottom Sweep	750SS x LAR	MIL	HA
1	Drip Cap	8100S x LAR	MIL	HA

2. NOTE: Install 881S weatherstripping before door closer.

E. **SET #04**
1. Doors: 101, 207

6	Hinges	BB1279 4 1/2 x 4 1/2	US26D	HA
2	Flush Bolts	282D	US26D	HA
1	Dust Proof Strike	280X	US26D	HA
1	Storeroom Lock	3480 ARC 3/4" Throw	US26D	HA
2	Armor Plates	190S 36" x 1" LDW CSK	US32D	HA
2	Overhead Holders	7017 SRF	US32D	HA

1	Overlapping Astragal	837SS x LAR	MIL	HA
1	Smoke Seal	726S x LAR	CHARCOAL	HA

F. **SET #05**

1. Doors: 102, 104, 202

3	Hinges	BB1279 4 1/2 X 4 1/2	US26D	HA
1	Storeroom Lock	3480 ARC 3/4" Throw	US26D	HA
1	Closer	5100	ALM	HA
1	Kick Plate	190S 10" x 2" LDW CSK	US32D	HA
1	Wall Stop	232W	US32D	HA
3	Door Silencers	307D	GREY	HA

a. NOTE: Door closer set to 180 degree opening.

G. **SET #06**

1. Doors: 103, 105, 116, 200, 201, 205, 206, 208

3	Hinges	BB1279 4 1/2 x 4 1/2	US26D	HA
1	Entrance Lock	3453 ARC	US26D	HA
3	Door Silencers	307D	GREY	HA
1	Smoke Seal	726S x LAR	CHARCOAL	HA

H. **SET #07**

1. Doors: 111, 203, 204.

3	Hinges	BB1199 4 1/2 X 4 1/2	US32D	HA
1	Privacy Set	3440 ARC	US32D	HA
1	Wall Stop	232W	US32D	HA
2	Hat and Coat Hook	571	US32D	IVES
3	Door Silencers	307D	GREY	HA
1	Sign ADA RESTROOM	354A		HA

2. NOTE: Provide ADA restroom signs as needed.
3. Mount (1) coat hook at ADA height (48" max), (1) at 5'-6".

I. **SET #08**

1. Doors: 500

3	Hinges	BB1191 4 1/2 x 4 1/2 NRP	US32D	HA
1	Entrance Lock	3453 ARC	US26D	HA
1	Closer	5100 HDCS	ALM	HA
1	Door sweep	By door manufacturer		KWN
3	Threshold	By door manufacturer		KWN
1	Weatherstrip	By door manufacturer		KWN

J. **SET #09**

1. Doors: 600

3	Hinges	BB1279 4 1/2 x 4 1/2	US26D	HA
1	Entrance Lock	3453 ARC	US26D	HA
1	Door seal	By door manufacturer		KWN

K. **SET #10**

1. Doors: 107

3	Hinges	BB1279 4 1/2 x 4 1/2	US26D	HA
1	Exit Device	4501 RIM F	US32D	HA
1	Exit Device Trim	45CE ARC	US26D	HA
1	Mortise Cylinder	3902 x LAR	US26D	HA
1	Closer	5100 HDCS	ALM	HA
1	Kick Plate	190S 10" x 2" LDW CSK	US32D	HA

1	Smoke Seal	726S x LAR	CHARCOAL	HA

L. **SET #11**

1. Doors: 118

3	Hinges	BB1279 4 1/2 X 4 1/2	US26D	HA
1	Passage Lock	34100 ARC	US26D	HA
1	Closer	5100	ALM	HA
1	Armor Plate	190S 36" x 2" LDW CSK	US32D	HA
1	Wall Stop	232W	US32D	HA
3	Door Silencers	307D	GREY	HA

a. NOTE: Door closer set to 180 degree opening.

END OF SECTION

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SECTION 088000
GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Insulating glass units.

B. Glazing units.

C. Glazing compounds and accessories.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials Current Edition.

B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test 2015.

C. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers 2005 (Reapproved 2019).

D. ASTM C1036 - Standard Specification for Flat Glass 2021.

E. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass 2018.

F. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass 2019.

G. ASTM C1193 - Standard Guide for Use of Joint Sealants 2016.

H. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass 2021.

I. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings 2016.

J. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation 2010.

K. GANA (GM) - GANA Glazing Manual 2008.

L. GANA (SM) - GANA Sealant Manual 2008.

M. GANA (LGRM) - Laminated Glazing Reference Manual 2009.

N. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use 1990 (2016).

O. NFRC 100 - Procedure for Determining Fenestration Product U-factors 2017.

P. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence 2014, with Errata (2017).

Q. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems 2017.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data on Insulating Glass Unit, Glazing Unit, and Plastic Sheet Glazing Unit Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.

D. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with GANA (GM), GANA (SM), GANA (LGRM), and IGMA TM-3000 for glazing installation methods. Maintain one copy on site.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

1.06 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 40 degrees F (4 degrees C).

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.07 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

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

C. Laminated Glass: Provide a five (5) year manufacturer warranty to include coverage for delamination, including providing products to replace failed units.

D. Polycarbonate Sheet Glazing: Provide a five (5) year manufacturer warranty to include coverage for breakage, coating failure, abrasion resistance, including providing products to replace failed units.

PART 2 PRODUCTS

2.01 GLAZING ELEMENTS

A. (08.8000.00) Float glass, basic glazing lites

B. (08.8000.01) Fully tempered safety glass

C. (08.8000.02) Wired glass

D. (08.8000.03) Laminated glass

E. (08.8000.04) Insulated glass unit; Vitro Architectural Glass Solaban 60

F. (08.8000.05) Insulating Glass Units: Spandrel glazing.

2.02 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
   1. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
   2. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
   3. Glass thicknesses listed are minimum.

B. Vapor Retarder and Air Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure vapor retarder and air barrier.
   1. In conjunction with vapor retarder and joint sealer materials described in other sections.

C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
   1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
   2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
   3. Solar Optical Properties: Comply with NFRC 300 test method.

2.03 GLASS MATERIALS

A. Float Glass: Provide float glass based glazing unless otherwise indicated.
   1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality - Q3.
   2. Kind HS - Heat-Strengthened Type: Complies with ASTM C1048.

B. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.

C. Wired Glass Type: ASTM C1036, Type II - Wired Flat Glass, Quality - Q6, with color and performance characteristics as indicated.

D. Laminated Glass: Float glass laminated in accordance with ASTM C1172.
   1. Laminated Safety Glass: Complies with ANSI Z97.1 - Class B or 16 CFR 1201 - Category I impact test requirements.

2.04 INSULATING GLASS UNITS

A. Manufacturers:
   1. Vitro Architectural Glass (formerly PPG Glass): www.vitroglazings.com/#sle.
   2. Substitutions: See Section 016000 - Product Requirements.

2.05 INSULATING GLASS UNITS: TYPES AS INDICATED.

A. Durability: Certified by an independent testing agency to comply with ASTM E2190.

B. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.

C. Spacer Color: Black.

D. Edge Seal:
   1. Color: Black.

E. Purge interpane space with dry air, hermetically sealed.

F. (08.8000.05) Insulating Glass Units: Spandrel glazing.
   1. Applications: Exterior spandrel glazing unless otherwise indicated.
   2. Space between lites filled with argon.
   3. Outboard Lite: Heat-strengthened float glass, 1/4 inch (6.4 mm) thick, minimum.
      a. Tint: as selected by Engineer from manufacturer's standard selection.
      b. Coating: Same as on vision units, on #2 surface.
   4. Inboard Lite: Heat-strengthened float glass, 1/4 inch (6.4 mm) thick.
      a. Tint: as selected by Engineer from manufacturer's standard selection.
   5. Total Thickness: 1 inch (25.4 mm).
   6. Thermal Transmittance (U-Value): per code, nominal.
   7. Glazing Method: Dry glazing method, gasket glazing.

2.06 BASIS OF DESIGN - INSULATING GLASS UNITS

A. Solarban 60 Insulating glass unit; Vitro Architectural Glass (formerly PPG Glass): www.vitroglazings.com/#sle.
   1. Outboard Lite: Heat-strengthened float glass, 1/4 inch (6.4 mm) thick, minimum.
      a. Low-E Coating: Vitro Architectural Glass (formerly PPG Glass) Solarban 60 on #2 surface.
      b. Glass: Clear.
   2. Inboard Lite: Heat-strengthened float glass, 1/4 inch (6.4 mm) thick.
      a. Coating: No coating on inboard lite.
      b. Glass: Clear.

2.07 ACCESSORIES

A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot (25 mm for each square meter) of glazing or minimum 4 inch (100 mm) by width of glazing rabbet space minus 1/16 inch (1.5 mm) by height to suit glazing method and pane weight and area.

B. Glazing Splines: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.

B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

3.02 PREPARATION

A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION, GENERAL

A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.

B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.

3.04 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)

A. Application - Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building.

B. Place setting blocks at 1/4 points with edge block no more than 6 inch (152 mm) from corners.

C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.

D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

END OF SECTION

SECTION 089100
LOUVERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Louvers, frames, and accessories.

1.02 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2017a.

B. AMCA 511 - Certified Ratings Program for Air Control Devices 2010.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data describing design characteristics, maximum recommended air velocity, design free area, materials and finishes.

C. Samples: Submit two samples 2 by 2 inches (50 by 50 mm) in size illustrating finish and color of exterior and interior surfaces.

D. Test Reports: Independent agency reports showing compliance with specified performance criteria.

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

F. Maintenance Data: Include lubrication schedules, adjustment requirements.

1.04 WARRANTY

A. Provide five year manufacturer's warranty against distortion, metal degradation, and connection failures of louver components.

PART 2 PRODUCTS

2.01 LOUVER ELEMENTS

A. (08.9100.00) Operable louver with horizontal blades.

2.02 MANUFACTURERS

A. Louvers:
   1. Airline Louvers: www.airlinelouvers.com/#sle.
   2. Airolite Company, LLC: www.airolite.com/#sle.
   3. Construction Specialties, Inc: www.c-sgroup.com/#sle.
   4. Greenheck Fan Corporation; www.greenheck.com
   5. Substitutions: See Section 016000 - Product Requirements.

2.03 LOUVERS

A. Louvers: Factory fabricated and assembled, complete with frame, mullions, and accessories; AMCA Certified in accordance with AMCA 511.

B. Operable Louvers: Operable horizontal blades, formed galvanized steel sheet construction.
   1. Free Area: 50 percent, minimum.
   2. Operation: Gravity balanced, 90 degree opening, with adjustment device to permit setting for varying differential static pressure.
   3. Movable Blades: Straight, pivoted at, with vinyl, rubber, or polyethylene blade edge and jamb seals; rattle-free linkage.
   4. Frame: depth to be determined, channel profile; corner joints mitered and, with continuous recessed caulking channel each side.
   5. Steel Thickness, Galvanized: Frame 16 gauge, 0.0598 inch (1.52 mm) minimum base metal; blades 16 gauge, 0.0598 inch (1.52 mm) minimum base metal.
   6. Steel Finish: Superior performing organic coatings, finished after fabrication.

2.04 MATERIALS

A. Steel Sheet: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.

2.05 FINISHES

A. Superior Performing Organic Coatings System: Manufacturer's standard multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent polyvinylidene fluoride (PVDF) resin, and at least 80 percent of aluminum extrusion and panels surfaces having minimum total dry film thickness (DFT) of 1.2 mils, 0.0012 inch (0.030 mm).

B. Primer: Zinc chromate, alkyd type.

C. Color: As selected from manufacturer's standard colors.

2.06 ACCESSORIES

A. Screens: Frame of same material as louver, with reinforced corners; removable, screw attached; installed on inside face of louver frame.

B. Fasteners and Anchors: Galvanized steel.

C. Flashings: Of same material as louver frame, formed to required shape, single length in one piece per location.

D. Sealant for Setting Sills and Sill Flashing: Non-curing butyl type.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install louver assembly in accordance with manufacturer's instructions.

B. Install louvers level and plumb.

C. Install flashings and align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.

D. Secure louver frames in openings with concealed fasteners.

3.02 ADJUSTING

A. Adjust operable louvers for freedom of movement of control mechanism. Lubricate operating joints.

3.03 CLEANING

A. Clean surfaces and components.

END OF SECTION

SECTION 090010
FINISH SCHEDULE

FINISHES

1.01 ROOMS

A. Waiting Area #100

Floor Tile	Porcelanosa	Urbatek Grupo Max Grey 12"x24"
Wall Base	4" High Ceramic to match floor	4"x24" w/Schluter Edge
Grout	Laticrete	45 Raven
Ceiling	Armstrong	Ultima Health Zone High NRC - White
Floor - Walk Off Mat	Amarco	Black
Wall Paint	Benjamin Moore	Timberwolf #1600 Eggshell Finish - Confirm w/ Owner and Engineer prior to ordering
Accent Wall Paint	Benjamin Moore	Stormy Sky #1616 Eggshell Finish - Confirm w/ Owner and Engineer prior to Ordering

B. Employee Break Room #101

Door	Sherwin Williams	Iron Ore SW-7069
Floor Tile	Porcelanosa	Urbatek Grupo Max Grey 12"x24"
Floor Grout	Laticrete	45 Raven
Floor Walk Off Mat	Amarco - Black	
Wall Base	4" High Ceramic to match floor	4"x24" w/Schluter Edge
Ceiling	Armstrong	Ultima Health Zone High NRC - White
Paint	Benjamin Moore	Timberwolf #1600 Eggshell Finish - Confirm w/ Owner and Engineer prior to ordering
Countertop	Caesarstone	2003 Concrete
Cabinets	Wilsonart Premium Laminate	Field Elm SoftGrain Finish with Aeon 7999K-12
Backsplash	Daltile Color Wheel Linear	0190 Artic White Matte 4"x13"
Wall Grout	Laticrete	44 Bright White

C. Sprinkler Room #102

Door	Benjamin Moore	Stormy Sky #1616
Ceiling	Exposed	
Wall Paint	Benjamin Moore	White Christmas #872 Eggshell Finish
Floor	Sealed Concrete	
Wall Base	Armstrong	Color-Integrated Wall Base 60 Jet Black

D. Corridor #103

Floor Tile	Porcelanosa	Urbatek Grupo Max Grey 12"x24"
Wall Base	4" High Ceramic to match floor	4"x24" w/Schluter Edge
Communicating Stairs	Sealed Concrete	Brushed Finish
Stair Railing/Stringer	Benjamin Moore	Stormy Sky #1616 Eggshell Finish - Confirm w/ Owner and Engineer prior to Ordering
Ceiling	Armstrong	Ultima Health Zone High NRC - White
Window	Anodized Aluminum	
Paint	Benjamin Moore	Timberwolf #1600 Eggshell Finish- Confirm w/ Owner and Engineer prior to ordering
Floor Grout	Laticrete 45 Raven	

E. Women's Toilet #104

Door	Sherwin Williams	Iron Ore SW-7069
Ceiling	Armstrong	Ultima Health Zone High NRC - White
Wall	Daltile Color Wheel Linear	Arctic White 0190
Wall Paint	Benjamin Moore	White Christmas #872 Eggshell Finish
Floor Tile	Porcelanosa	Urbatek Grupo Morse White 12"x24"
Floor Grout	Laticrete	24 Natural Gray
Wall Grout	Laticrete	44 Bright White
Wall Base	Daltile Color Wheel Cove Base	Artic White 0190
Partitions	ASI Global	3020 Graphite Grafix

F. Women's Locker #105

Ceiling	Armstrong	Ultima Health Zone High NRC - White
Wall Paint	Benjamin Moore	White Christmas #872 Eggshell Finish
Wall	FRP	White, Orange Peel Finish
Floor Tile	Porcelanosa	Urbatek Grupo Morse White 12"x24"
Floor Grout	Laticrete	24 Natural Gray
Wall	FRP	White, Orange Peel Finish
Wall Base	Daltile Color Wheel Cove Base	Artic White 0190

G. Men's Toilet #106

Door	Sherwin Williams	Iron Ore SW-7069
Ceiling	Armstrong	Ultima Health Zone High NRC - White
Wall	Daltile Color Wheel Linear	Artic White 0190
Wall Paint	Benjamin Moore	White Christmas #872

		Eggshell Finish
Floor Tile	Porcelanosa	Urbatek Grupo Morse White 12"x24"
Floor Grout	Laticrete	24 Natural Gray
Wall Grout	Laticrete	44 Bright White
Wall Base	Daltile Color Wheel Cove Base	Artic White 0190
Partitions	ASI Global	3020 Graphite Grafix

H. Men's Locker #107

Ceiling	Armstrong	Ultima Health Zone High NRC - White
Wall Paint	Benjamin Moore	White Christmas #872 Eggshell Finish
Wall	FRP	White, Orange Peel Finish
Floor Tile	Porcelanosa	Urbatek Grupo Morse White 12"x24"
Floor Grout	Laticrete	24 Natural Gray
Wall	FRP	White, Orange Peel Finish
Wall Base	Daltile Color Wheel Cove Base	Artic White 0190

I. Closet #108

Door	Sherwin Williams	Iron Ore SW-7069
Ceiling	Benjamin Moore	White Christmas #872 Eggshell Finish
Wall	Benjamin Moore	White Christmas #872 Eggshell Finish
Floor Tile	Porcelanosa	Urbatek Grupo Max Grey 12"x24"
Wall Base	4" High Ceramic to match floor	4"x24" w/Schluter Edge
Grout	Laticrete	45 Raven

J. Equipment Closet #109

Door	Sherwin Williams	Iron Ore SW-7069
Ceiling	Benjamin Moore	White Christmas #872 Eggshell Finish
Wall	Benjamin Moore	White Christmas #872 Eggshell Finish
Floor	Polished Concrete	
Wall Base	Armstrong	Color-Integrated Wall Base 60 Jet Black

K. Corridor #110

Door	Sherwin Williams	Iron Ore SW-7069
Ceiling	Armstrong	Ultima Health Zone High NRC - White
Wall Paint	Benjamin Moore	Timberwolf #1600 Eggshell Finish - Confirm w/ Owner and Engineer prior to ordering
Floor	Polished Concrete	

Wall Base	Armstrong	Color-Integrated Wall Base 60 Jet Black

L. Compressor Room #111

Door	Sherwin Williams	Iron Ore SW-7069
Ceiling	Exposed	
Wall Paint	Benjamin Moore	Timberwolf #1600 Eggshell Finish - Confirm w/ Owner and Engineer prior to ordering
Floor	Polished Concrete	
Wall Base	Armstrong	Color-Integrated Wall Base 60 Jet Black

M. Parts & Tools Storage #112

Door	Sherwin Williams	Iron Ore SW-7069
Ceiling	Exposed	White Christmas #872 Eggshell Finish
Wall Paint	Benjamin Moore	Timberwolf #1600 Eggshell Finish - Confirm w/ Owner and Engineer prior to ordering
Floor	Polished Concrete	
Wall Base	Armstrong	Color-Integrated Wall Base 60 Jet Black

N. Electrical #113

Door	Sherwin Williams	Iron Ore SW-7069
Ceiling	Exposed	White Christmas #872 Eggshell Finish
Wall Paint	Benjamin Moore	White Christmas #872 Eggshell Finish
Floor	Polished Concrete	
Wall Base	Armstrong	Color-Integrated Wall Base 60 Jet Black

O. Janitors Closet #114

Door	Sherwin Williams	Iron Ore SW-7069
Ceiling	Benjamin Moore	White Christmas #872 Eggshell Finish
Wall	Benjamin Moore	White Christmas #872 Eggshell Finish
Floor Tile	Porcelanosa	Urbatek Grupo Max Grey 12"x24"
Wall Base	4" High Ceramic to match floor	4"x24" w/Schluter Edge
Grout	Laticrete	45 Raven

P. Stairs #115

Door	Sherwin Williams	Iron Ore SW-7069
Ceiling	Benjamin Moore	White Christmas #872 Eggshell Finish
Wall	Benjamin Moore	White Christmas #872 Eggshell Finish
Floor Tile	Porcelanosa	Urbatek Grupo Max Grey 12"x24"

Wall Base	4" High Ceramic to match floor	4"x24" w/Schluter Edge
Grout	Laticrete	45 Raven

Q. Conference Room #200

VCT	Armstrong	Standard Excelon Imperial Texture 57532 Grayson
Ceiling	Armstrong	Ultima Health Zone High NRC - White
Wall Base	Armstrong Color-Integrated Wall Base 60 Jet Black	Color-Integrated Wall Base 60 Jet Black
Paint	Benjamin Moore	Timberwolf #1600 Eggshell Finish - Confirm w/ Owner and Engineer prior to ordering
Window Sills	Caesarstone	2003 Concrete

R. Open Office #201

Door	Sherwin Williams	Iron Ore SW-7069
Floor Tile		
Window Sills	Caesarstone	2003 Concrete
Wall Base	Armstrong	Color-Integrated Wall Base 60 Jet Black
Ceiling	Armstrong	Ultima Health Zone High NRC - White
Paint	Benjamin Moore	Timberwolf #1600 Eggshell Finish - Confirm w/ Owner and Engineer prior to ordering

S. Coffee/Copy #204

Ceiling	Armstrong	Ultima Health Zone High NRC - White
Wall Base	Armstrong	Color-Integrated Wall Base 60 Jet Black
Paint	Benjamin Moore	Timberwolf #1600 Eggshell Finish - Confirm w/ Owner and Engineer prior to ordering
Countertop	Wilsonart	Premium Laminate Field Elm SoftGrain Finish with Aeon 7999K-12
Base Cabinets	Wilsonart	Premium Laminate Portico Teak 8210K-28 Gloss Line Finish with Aeon
Backsplash	8" High to match countertop	

T. Office #205

Door	Sherwin Williams	Iron Ore SW-7069
Carpet	Milliken	Arcadia Undercurrent UNR13-180 Halcyon
Window Sills	Caesarstone	2003 Concrete
Wall Base	Armstrong	Color-Integrated Wall Base 60 Jet Black
Ceiling	Armstrong	Ultima Health Zone High NRC

		- White
Walls	Benjamin Moore	White Christmas #872 Eggshell Finish - Confirm w/ Owner and Engineer prior to ordering

U. Unisex Toilet Room #207

Door	Sherwin Williams	Iron Ore SW-7069
Ceiling	Armstrong	Ultima Health Zone High NRC - White
Wall	Daltile Color Wheel Linear	Artic White 0190
Wall Paint	Benjamin Moore	White Christmas #872 Eggshell Finish
Floor Tile	Porcelanosa	Urbatek Grupo Morse White 12"x24"
Floor Grout	Laticrete	24 Natural Gray
Wall Grout	Laticrete	44 Bright White

V. Unisex Toilet Room #208

Door	Sherwin Williams	Iron Ore SW-7069
Ceiling	Armstrong	Ultima Health Zone High NRC - White
Wall	Daltile Color Wheel Linear	Artic White 0190
Wall Paint	Benjamin Moore	White Christmas #872 Eggshell Finish
Floor Tile	Porcelanosa	Urbatek Grupo Morse White 12"x24"
Floor Grout	Laticrete	24 Natural Gray
Wall Grout	Laticrete	44 Bright White
Wall Base	Daltile Color Wheel Cove Base	Artic White 0190

W. Rockland Green Room #209

Door	Sherwin Williams	Iron Ore SW-7069
Carpet	Milliken	Arcadia Undercurrent UNR13-180 Halcyon
Window Sills	Caesarstone	2003 Concrete
Wall Base	Armstrong	Color-Integrated Wall Base 60 Jet Black
Ceiling	Armstrong	Ultima Health Zone High NRC - White
Walls	Benjamin Moore	White Christmas #872 Eggshell Finish - Confirm w/ Owner and Engneer prior to ordering

X. IT Closet #210

Door	Sherwin Williams	Iron Ore SW-7069
Ceiling	Benjamin Moore	White Christmas #872 Eggshell Finish
Wall	Benjamin Moore	White Christmas #872 Eggshell Finish
Wall Base	Armstrong	Color-Integrated Wall Base 60

		Jet Black
Floor Tile	Armstrong	Anti-Static VCT - Grey

Y. Storage #211

Door	Sherwin Williams	Iron Ore SW-7069
Ceiling	Benjamin Moore	White Christmas #872 Eggshell Finish
Wall	Benjamin Moore	White Christmas #872 Eggshell Finish
Floor	Polished Concrete	
Wall Base	Armstrong	Color-Integrated Wall Base 60 Jet Black

Z. Office #212

Door	Sherwin Williams	Iron Ore SW-7069
VCT	Armstrong	Standard Excelon Imperial Texture 57551 Perfect StormStandard Excelon Imperial Texture 57551 Perfect Storm
Window Sills	Caesarstone	2003 Concrete
Wall Base	Armstrong	Color-Integrated Wall Base 60 Jet Black
Ceiling	Armstrong	Ultima Health Zone High NRC - White
Walls	Benjamin Moore	White Christmas #872 Eggshell Finish - Confirm w/ Owner and Engineer prior to ordering

AA. Office #213

Door	Sherwin Williams	Iron Ore SW-7069
VCT	Armstrong	Standard Excelon Imperial Texture 57551 Perfect Storm
Window Sills	Caesarstone	2003 Concrete
Wall Base	Armstrong	Color-Integrated Wall Base 60 Jet Black
Ceiling	Armstrong	Ultima Health Zone High NRC - White
Walls	Benjamin Moore	White Christmas #872 Eggshell Finish - Confirm w/ Owner and Engineer prior to ordering

BB. Office #214

Door	Sherwin Williams	Iron Ore SW-7069
VCT	Armstrong	Standard Excelon Imperial Texture 57551 Perfect StormStandard Excelon Imperial Texture 57551 Perfect Storm
Window Sills	Caesarstone	2003 Concrete
Wall Base	Armstrong	Color-Integrated Wall Base 60

		Jet Black
Ceiling	Armstrong	Ultima Health Zone High NRC - White
Walls	Benjamin Moore	White Christmas #872 Eggshell Finish - Confirm w/ Owner and Engineer prior to ordering

END OF SECTION

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SECTION 092116
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Performance criteria for gypsum board assemblies.

B. Metal stud wall framing.

C. Cementitious backing board.

D. Gypsum wallboard.

E. Joint treatment and accessories.

1.02 RELATED REQUIREMENTS

A. Section 054000 - Cold-Formed Metal Framing: Structural steel stud framing.

B. Section 072100 - Thermal Insulation: Acoustic insulation.

C. Section 079200 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

D. Section 09 0010 - Gypsum Board Wall Assemblies

E. Section 092216 - Non-Structural Metal Framing.

1.03 REFERENCE STANDARDS

A. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units 2018.

B. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units 1999 (Reaffirmed 2016).

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.

D. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board 2017.

E. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members 2018.

F. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products 2020.

G. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board 2020.

H. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness 2018.

I. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs 2020.

J. ASTM C1047 - Standard Specification for Accessories For Gypsum Wallboard and Gypsum Veneer Base 2019.

K. ASTM C1288 - Standard Specification for Discrete Non-Asbestos Fiber-Cement Interior Substrate Sheets 2017.

L. ASTM C1325 - Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units 2019.

M. ASTM C1396/C1396M - Standard Specification for Gypsum Board 2017.

N. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels 2019.

O. ASTM C1658/C1658M - Standard Specification for Glass Mat Gypsum Panels 2019, with Ediorial Revision (2020).

P. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber 2016.

Q. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.

R. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 2009 (Reapproved 2016).

S. ASTM E413 - Classification for Rating Sound Insulation 2016.

T. GA-216 - Application and Finishing of Gypsum Panel Products 2018.

U. UL 752 - Standard for Bullet-Resisting Equipment Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.

C. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.

D. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

E. Test Reports: For stud framing products that do not comply with ASTM C645 or ASTM C754, provide independent laboratory reports showing maximum stud heights at required spacings and deflections.

F. Test Reports: Bullet resistant sheathing and wallboard.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing gypsum board installation and finishing.

B. Copies of Documents at Site: Maintain at the project site a copy of each referenced document that prescribes execution requirements.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.

B. Interior Partitions, Indicated as Acoustic: Provide completed assemblies with the following characteristics:
   1. Acoustic Attenuation: STC of 45-49 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

C. Shaft Walls at HVAC Shafts: Provide completed assemblies with the following characteristics:
   1. Air Pressure Within Shaft: Sustained loads of 5 lbf/sq ft (0.24 kPa) with maximum mid-span deflection of L/240.
   2. Acoustic Attenuation: STC of 35-39 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

D. Shaft Walls at Elevator Shafts: Provide completed assemblies with the following characteristics:
   1. Air Pressure Within Shaft: Intermittent loads of 5 lbf/sq ft (0.24 kPa) with maximum mid-span deflection of L/240.
   2. Acoustic Attenuation: STC of 35-39 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

2.02 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
   1. American Gypsum Company: www.americangypsum.com.
   2. CertainTeed Corporation: www.certainteed.com.
   3. Continental Building Products: www.continental-bp.com.
   4. Georgia-Pacific Gypsum: www.gpgypsum.com.
   5. National Gypsum Company; Gold Bond: www.nationalgypsum.com.
   6. USG Corporation: www.usg.com.

B. (09.2116.51) 1/4" GWB, flexible GWBI.

C. (09.2116.52) 1/2" regular GWB.

D. (09.2116.53) 1/2" type 'X' GWB

E. (09.2116.54) 5/8" regular GWB.

F. (09.2116.55) 5/8" type X GWB.

G. (09.2116.56) 3/4" regular GWB.

H. (09.2116.57) 3/4" type X GWB.

I. (09.2116.58) 1" Type X SLX shaftliner GWB

J. (09.2116.59) 1/2" MR type X GWB.

K. (09.2116.60) 5/8" MR Type X GWB.

L. (09.2116.61) 1/2" type X veneer plaster GWB

M. (09.2116.62) 5/8" type X veneer plaster GWB

N. (09.2116.63) 1/2" Acoustical GWB, XP.

O. (09.2116.64) 5/8" Acoustical GWB; XP.

P. (09.2116.65) 3/4" acoustical GWB XP.

Q. (09.2116.66) 1/2" cement board.

R. (09.2116.67) 5/8" cement board.

S. (09.2116.68) 1/2" MR GWB.

T. (09.2116.69) 5/8" MR GWB.

2.03 BACKING BOARD FOR WET AREAS:

A. Application: Surfaces behind all tile in wet and dry areas including locker rooms and rest rooms.

B. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.

C. ANSI Cement-Based Board: Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A118.9 or ASTM C1325.
   1. Products:
      a. Custom Building Products: www.custombuildingproducts.com.
      b. National Gypsum Company; PermaBase Cement Board: www.nationalgypsum.com/#sle.
      c. USG Corporation: www.usg.com.
      d. Substitutions: See Section 016000 - Product Requirements.

D. ASTM Cement-Based Board: Non-gypsum-based, cementitious board complying with ASTM C1288.
   1. Products:
      a. James Hardie Building Products, Inc: www.jameshardie.com.
      b. Substitutions: See Section 016000 - Product Requirements.

E. Shaftwall and Coreboard: Type X; 1 inch (25 mm) thick by 24 inches (610 mm) wide, beveled long edges, ends square cut.
   1. Paper-Faced Products:
      a. CertainTeed Corporation; M2Tech Type X Shaftliner: www.certainteed.com/#sle.
      b. Georgia-Pacific Gypsum; ToughRock Shaftliner: www.gpgypsum.com/#sle.
      c. National Gypsum Company; Gold Bond Fire-Shield Shaftliner XP: www.nationalgypsum.com/#sle.

2.04 GYPSUM WALLBOARD ACCESSORIES

A. Acoustic Insulation: As specified in Section 072100.

B. Sound Isolation Tape: Elastomeric foam tape for sound decoupling.
   1. Surface Burning Characteristics: Provide assemblies with flame spread index of 75 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
   2. Tape Thickness: 1/4 inch (6 mm).

3. Products:
    a. Armacell LLC; ArmaSound MTD: www.armacell.us/#sle.
    b. Substitutions: See Section 016000 - Product Requirements.

C. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.
1. Products:
    a. Franklin International, Inc; Titebond GREENchoice Professional Acoustical Smoke and Sound Sealant: www.titebond.com/#sle.
    b. Liquid Nails, a brand of PPG Architectural Coatings; [_____]: www.liquidnails.com/#sle.
    c. Substitutions: See Section 016000 - Product Requirements.

D. Finishing Accessories: ASTM C1047, galvanized steel, rolled zinc, or rigid plastic, unless noted otherwise.
1. Types: As detailed or required for finished appearance.
2. Products:
    a. Trim-tex, Inc: www.trim-tex.com/#sle.
    b. Substitutions: See Section 016000 - Product Requirements.

E. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
1. Fiberglass Tape: 2 inch (50 mm) wide, coated glass fiber tape for joints and corners, except as otherwise indicated.
2. Paper Tape: 2 inch (50 mm) wide, creased paper tape for joints and corners, except as otherwise indicated.
3. Joint Compound: Drying type, vinyl-based, ready-mixed.
    a. Products:
        1) [_____].
4. Joint Compound: Setting type, field-mixed.
    a. Products:

F. High Build Drywall Surfacer: Vinyl acrylic latex-based coating for spray application, designed to take the place of skim coating and separate paint primer in achieving Level 5 finish.
1. Products:
    a. CertainTeed Corporation; Level V Wall and Ceiling Primer/Surfacer with M2Tech: www.certainteed.com/#sle.
    b. Substitutions: See Section 016000 - Product Requirements.

G. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inches (0.84 mm) in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion-resistant.

H. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch (0.84 to 2.84 mm) in Thickness: ASTM C954; steel drill screws, corrosion-resistant.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

B. Sound Isolation Tape: Apply to vertical studs and top and bottom tracks/runners in accordance with manufacturer's instructions.

C. Acoustic Sealant: Install in accordance with manufacturer's instructions.

3.03 BOARD INSTALLATION

A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.

C. Cementitious Backing Board: Install over steel framing members and plywood substrate where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.

3.04 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
   1. Not more than 30 feet (10 meters) apart on walls and ceilings over 50 feet (16 meters) long.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.05 JOINT TREATMENT

A. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
   1. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish and other areas specifically indicated.
      a. "Level 5" finish per GA-214:
         1) All joints and interior angles shall have tape embedded in joint compound and shall be immediately wiped with a joint knife leaving a thin coating of joint compound over all joints and interior angles. Two separate coats of joint compound shall be applied over all flat joints and one separate coat of joint compound shall be applied over interior angles. Fastener heads and accessories shall be covered with three separate coats of joint compound. A thin skim coat of joint compound trowel applied, or a material manufactured especially for this purpose and applied in accordance with manufacturer's recommendations, applied to the entire surface. The surface shall be smooth and free of tool marks and ridges. Note: It is recommended that the prepared surface be coated with a drywall primer prior to the application of finish paint. See painting specification in this regard.
      b. Primer and Paint Application:
         1) Use a high quality, high build drywall primer/surfacer. Comply with application instructions of the primer manufacturer as stated on the container.
   2. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
   3. Level 3: In utility areas.
   4. Level 2: Behind cabinetry, and on backing board to receive tile finish.
   5. Level 1: Fire-resistance-rated wall areas above finished ceilings, whether or not accessible in the completed construction.

B. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
   1. Feather coats of joint compound so that camber is maximum 1/32 inch (0.8 mm).

C. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

END OF SECTION

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SECTION 092216
NON-STRUCTURAL METAL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal partition, ceiling, and soffit framing.

B. Framing accessories.

1.02 RELATED REQUIREMENTS

A. Section 072100 - Thermal Insulation: Acoustic insulation.

B. Section 078400 - Firestopping: Sealing top-of-wall assemblies at fire-resistance-rated walls.

C. Section 079200 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

D. Section 092116 - Gypsum Board Assemblies: Metal studs for gypsum board partition framing.

E. Section 09 2117 - Acoustic Gypsum Board Assemblies: Acoustic sealant of assemblies.

1.03 REFERENCE STANDARDS

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

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.

C. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members 2015.

D. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members 2018.

E. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products 2020.

F. 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 2020.

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.

H. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 2009 (Reapproved 2016).

I. ASTM E413 - Classification for Rating Sound Insulation 2016.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Shop Drawings:
   1. Indicate prefabricated work, component details, stud layout, framed openings, anchorage to structure, acoustic details, type and location of fasteners, accessories, and items of other related work.
   2. Describe method for securing studs to tracks, splicing, and for blocking and reinforcement of framing connections.

C. Product Data: Provide data describing framing member materials and finish, product criteria, load charts, and limitations.

D. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

F. Sustainable Design Submittal: Documentation of recycled content and location of manufacture.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience and approved by manufacturer.

PART 2 PRODUCTS

2.01 NON-STRUCTURAL METAL FRAMING ELEMENTS

A. (09.2216.01) 1-5/8″ LG metal stud

B. (09.2216.02) 2-1/2″ LG metal stud

C. (09.2216.03) 3-1/2″ LG metal stud

D. (09.2216.04) 3-5/8″ LG metal stud

E. (09.2216.05) 4″ LG metal stud

F. (09.2216.06) 5-1/2″ LG metal stud

G. (09.2216.07) 6″ LG metal stud

H. (09.2216.08) 8″ LG metal stud

I. (09.2216.09)10″ LG metal stud

J. (09.2216.10)12″ LG metal stud

K. (09.2216.11)14″ LG metal stud

L. (09.2216.12) 16″ LG metal stud

M. (09.2216.13) Furring 7/8" hat channel

N. (09.2216.14) Furring, 1-1/2" hat channel

O. (09.2216.15) Furring, 1/2" Resilient channel

P. (09.2216.16) Acoustical stud, 3 5/8" SGW stud.

Q. (09.2216.17) Acoustical stud, 4" SGW stud.

R. (09.2216.18) Acoustical stud, 6" SGW stud.

S. (09.2216.19) 'U' shaped track / runner

T. (09.2216.20) Deep leg deflection track

U. (09.2216.21) Lateral bracing, prenotched spacer bar.

V. (09.2216.22) Top of wall bracing, same gauge as stud, at 8'-0" o.c.; staggered w/ (2) #10 screws each end.

W. (09.2216.23) Clip angle, same gauge as stud w/(2) #10 screws

X. (09.2116.24) 'U' shaped top track / runner

Y. (09.2116.25) 'U' shaped bottom track / runner

Z. (09.2116.26) 2-1/2" deep leg deflection track

AA. (09.2116.27) 3" deep leg deflection track

BB. (09.2116.28) 2-1/2" Shaftwall CH stud.

CC. (09.2116.29) 4" Shaftwall CH stud.

DD. (09.2116.30) 6" Shaftwall CH stud.

EE. (09.2116.31) Shaftwall J tabbed track / runner / jamb stud.

FF. (09.2116.32) 2" H stud.

GG. (09.2116.33) 24" High wall support LGPW24.

HH. (09.2116.34) 36" High wall support LGPW36.

II. (09.2116.35) 48" High wall support LGPW48.

JJ. (09.2116.36) 60" High wall support LGPW60.

KK. (09.2116.37) Acoustic sealant; face of stud, between track and ceiling / floor

LL. (09.2116.38) Acoustic sealant; face of each stud, between track and ceiling / floor

MM. (09.2116.100) Extruded aluminum partition closure; Window Mate

2.02 MANUFACTURERS

A. Metal Framing, Connectors, and Accessories:
   1. CEMCO: www.cemcosteel.com.
   2. ClarkDietrich Building Systems: www.clarkdietrich.com.
   3. Marino: www.marinoware.com.
   4. Gordon Interior Specialties Division, Gordon, Inc., 5023 Hazel Jones Road, Bossier City, LA 71111, (800) 747-8954, Fax (800) 877-8746, www.gordoninteriors.com, sales@gordoninteriors.com..
   5. Substitutions: See Section 016000 - Product Requirements.

2.03 FRAMING MATERIALS

A. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf (L/240 at 240 Pa).
   1. Studs: C shaped with knurled or embossed faces.
   2. Paired Studs for Sound-Rated Assemblies: Engineered single-piece assemblies comprised of paired studs coupled by sound isolators, designed to replace conventional side-by-side, parallel, double-wall partition framing.
      a. Widths: As indicated on drawings.
      b. Products:
         1) SCAFCO Corporation; SoundGuard Silent Steel Framing System: www.scafco.com/#sle.
         2) Marino Ware, SoundGuard; www.marinoware.com.
         3) Substitutions: See Section 016000 - Product Requirements.
   3. Runners: U shaped, sized to match studs.
   4. Furring: Hat-shaped sections, minimum depth of 7/8 inch (22 mm).
   5. Resilient Furring Channels: Single leg configuration; 1/2 inch (12 mm) channel depth.
   6. Shaft Wall Studs and Accessories: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 and specified performance requirements.
      a. Products:
         1) Same manufacturer as other framing materials.
         2) Studs: CH or CT.
         3) Track, runner, jamb strut: J tabbed runner / track.
         4) Substitutions: See Section 016000 - Product Requirements.
   7. Area Separation Wall Studs and Accessories: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with specified performance requirements.
      a. Products:
         1) Phillips Manufacturing Co: www.phillipsmfg.com/#sle.
         2) 2" H stud.
         3) Allows 2 layers of 1" liner panel to be placed with in wall cavity.
         4) Substitutions: See Section 016000 - Product Requirements.
   8. Partition Head to Structure Connections: Provide track fastened to structure with legs of sufficient length to accommodate deflection, for friction fit of studs cut short and fastened as indicated on drawings.
      a. Products:
         1) Clark Dietrich: www.clarkdietrich.com
            (a) 2-1/2" Leg MaxTRAK has 1-1/2" long slots with a total allowable vertical (deflection) movement of 1-1/2" (3/4"±)
            (b) 3" Leg MaxTRAK has 2" long slots with a total allowable vertical (deflection) movement of 2" (1"±)
         2) Substitutions: See Section01 6000-Product Requirements
   9. Deflection and Firestop Track: Intumescent strip factory-applied to track flanges expands when exposed to heat or flames to provide a perimeter joint seal.
      a. Products:
         1) ClarkDietrich; BlazeFrame Firestop Deflection Track: www.clarkdietrich.com/#sle.

2) Substitutions: See Section 016000 - Product Requirements.

10. Preformed Top Track Firestop Seal:
    a. Provide components UL-listed for use in UL-listed fire-resistance-rated head of partition joint systems indicated on drawings.
    b. Products:
        1) Hilti, Inc; Top Track Seal CFS TTS: www.us.hilti.com/#sle.
        2) Substitutions: See Section 016000 - Product Requirements.

2.04 NON-LOADBEARING FRAMING ACCESSORIES:

A. Partial Height Wall Framing Support: Provides stud reinforcement and anchored connection to floor.
    1. Materials: ASTM A36/A36M formed sheet steel support member with factory-welded ASTM A1003/A1003M steel plate base.
    2. Products:
        a. ClarkDietrich; Pony Wall (PW): www.clarkdietrich.com/#sle.
            1) LGPW24 = 23-5/8" tall with 2-3/8" wide x 5-1/2" long plate
            2) LGPW36 = 35-5/8" tall with 2-3/8" wide x 5-1/2" long plate
            3) LGPW48 = 47-5/8" tall with 2-3/8" wide x 5-1/2" long plate
            4) LGPW60 = 59-5/8" tall with 2-3/8" wide x 5-1/2" long plate
        b. Substitutions: See Section 016000 - Product Requirements.

B. Framing Connectors: ASTM A653/A653M G90 galvanized steel clips; secures cold rolled channel to wall studs for lateral bracing.

C. Sheet Metal Backing: 0.036 inch (0.9 mm) thick, galvanized.

D. Fasteners: ASTM C1002 self-piercing tapping screws.

E. Anchorage Devices: Powder actuated.

F. Sound Isolation Tape: Elastomeric foam tape for sound decoupling.
    1. Surface Burning Characteristics: Provide assemblies with flame spread index of 75 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
    2. Tape Thickness: 1/4 inch (6 mm).
    3. Products:
        a. Armacell LLC; ArmaSound MTD: www.armacell.us/#sle.
        b. Substitutions: See Section 016000 - Product Requirements.

G. Lateral bracing: Pre-notched bridging bars installed according to manufacturer's written instructions.
    1. Products; any one of the following:
        a. ClarkDietrich TradeReady Spazzer 5400 spacer bar
        b. Simpson Strong Tie DBR Drywall Spacer Bracer
        c. Cold rolled channel.

H. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.
    1. Products:
        a. Green Glue Noiseproofing Sealant; www/https://acousticalsolutions.com
        b. Noiseproofing Acoustical Sealant; www/http://www.soundproofingcompany.com
        c. Approved equal.

2.05 EXTRUDED ALUMINUM PARTITION CLOSURE

A. System description
    1. **WINDOW MATE – SERIES 40 PLUS** extruded aluminum partition closures are preassembled and spring loaded to provide a tight fit for vertical junctures of partitions and window walls. Mullion Mate is finished to match mullions in a spray applied water-borne cross-linked baked acrylic finish or Acrylic-Polyester hybrid powder coat paint finish or custom paints or anodized finish. They are sound tested to a composite STC of 56 with acoustical batts for sound attenuation.

B. Materials:

1. Aluminum extrusions: 6063-T5 temper, tensile strength 31 KSI (ASTM B 221, ASTM B 221 M).
   a. Product: **Window Mate 3 (SERIES 40 PLUS)** for openings 2-7/8" – 3-15/16", **Window Mate 4 (SERIES 40 PLUS)** for openings 4" – 4-15/16", **Window Mate 5 (SERIES 40 PLUS)** for openings 5" – 6-15/16", **Window Mate 7 (SERIES 40 PLUS)** for openings 7" – 9-3/4", or Window Mate 9 (SERIES 40 PLUS) for openings 9" – 13-3/4".
   b. Field specify lengths up to 16'.
2. Acoustical Batts for sound attenuation (as specified). **Factory-supplied caulk must be installed** in the field for acoustical performance purposes.
3. Accessories:
   a. Window Mate End Caps:
      1) Extruded: **MMEC-375** for 3-3/4" walls, **MMEC- 487** for 4-7/8" walls, **MMEC-600** for 6" walls, or **MMEC-725** for 7-1/4"
      2) Brake Formed: MMECBF-518 for 5-1/8" walls, MMECBF-514 for 5-1/4" walls, MMECBF-512 for 5-1/2" walls, MMECBF-618 for 6-1/8" walls, or MMECBF-812 for 8- 1/2" walls.
4. General: Provide metals free from surface blemishes where exposed to view in finished unit. Surfaces that exhibit pitting, seam marks, roller marks, stains, and discolorations, or other imperfections on finished units are not acceptable. All metal shall be of the highest-grade commercial type.
5. Fabrication:
   a. Provide extruded aluminum WINDOW MATE – SERIES 40 PLUS in specified lengths and size to fit specified openings.
6. Finish: All material shall be factory anodized in clear or medium bronze (Interior Application) or Acrylic-Polyester hybrid powder coat paint finish available in a variety of standard or custom colors.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

3.02 INSTALLATION OF STUD FRAMING

A. Extend partition framing to structure where indicated and to ceiling in other locations.

B. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.

C. Align and secure top and bottom runners at 24 inches (600 mm) on center.

D. At partitions indicated with an acoustic rating:
   1. Provide components and install as required to produce STC rating of 55, based on published tests by manufacturer conducted in accordance with ASTM E90 with STC rating calculated in accordance with ASTM E413.
   2. Place one bead of acoustic sealant between runners and substrate , studs and adjacent construction.
   3. Place one bead of acoustic sealant between studs and adjacent vertical surfaces.
   4. Sound Isolation Tape: Apply to vertical studs and top and bottom tracks/runners in accordance with manufacturer's instructions.

E. Fit runners under and above openings; secure intermediate studs to same spacing as wall studs.

F. Align stud web openings horizontally.

G. Secure studs to tracks using crimping method. Do not weld.

H. Fabricate corners using a minimum of three studs.

I. Install double studs at wall openings, door and window jambs, not more than 2 inches (50 mm) from each side of openings.

J. Coordinate installation of bucks, anchors, and blocking with electrical, mechanical, and other work to be placed within or behind stud framing.

K. Furring: Install at spacing and locations shown on drawings. Lap splices a minimum of 6 inches (150 mm).

3.03 CEILING AND SOFFIT FRAMING

A. Comply with requirements of ASTM C754.

B. Install furring after work above ceiling or soffit is complete. Coordinate the location of hangers with other work.

C. Install furring independent of walls, columns, and above-ceiling work.

D. Securely anchor hangers to structural members or embed them in structural slab. Space hangers as required to limit deflection to criteria indicated. Use rigid hangers at exterior soffits.

E. Space main carrying channels at maximum 48 inch ([____] mm) on center, and not more than 6 inches (150 mm) from wall surfaces. Lap splice securely.

F. Securely fix carrying channels to hangers to prevent turning or twisting and to transmit full load to hangers.

G. Place furring channels perpendicular to carrying channels, not more than 2 inches (50 mm) from perimeter walls, and rigidly secure. Lap splices securely.

3.04 TOLERANCES

A. Maximum Variation from True Position: 1/8 inch in 10 feet (3 mm in 3 m).

B. Maximum Variation from Plumb: 1/8 inch in 10 feet (3 mm in 3 m).

END OF SECTION

SECTION 093000
TILING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tile for floor applications.

B. Tile for wall applications.

1.02 REFERENCE STANDARDS

A. ANSI A137.1 - American National Standard Specifications for Ceramic Tile 2019.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.

C. Samples: Mount tile and apply grout on two plywood panels, minimum 18 by 18 inches (457 by 457 mm) in size illustrating pattern, color variations, and grout joint size variations.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.

B. Installer Qualifications: Natural Stone Institute (NSI) Accredited Commercial B Contractor (light commercial): www.naturalstoneinstitute.org/#sle.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.06 FIELD CONDITIONS

A. Maintain ambient and substrate temperature above 50 degrees F (10 degrees C) and below 100 degrees F (38 degrees C) during installation and curing of setting materials.

PART 2 PRODUCTS

2.01 TILING ELEMENTS

A. (09.3000.00) Ceramic mosaic tile, 1" x 1"

B. (09.3000.01 Ceramic mosaic tile, 2" x 2"

C. (09.3000.03) Glazed wall tile, 4" x 13"
   1. Dal-Tile Modern Dimensions #0190, Arctic White

D. (09.3000.06) Porcelain tile, 12" x 24" x 3/8"
   1. Porcelanosa "Urbatek, Grupo Morse"

2.02 TILE

A. Manufacturers: All products of each type by the same manufacturer.
   1. American Olean Corporation: www.americanolean.com/#sle.
   2. Dal-Tile Corporation: www.daltile.com/#sle.
   3. Emser Tile, LLC: www.emser.com/#sle.
   4. Porcelanosa; www.porcelanosa-usa.com.
   5. Substitutions: See Section 016000 - Product Requirements.

B. Ceramic Mosaic Tile: ANSI A137.1 standard grade.
   1. Size: 1 by 1 inch (25 by 25 mm), nominal.
   2. Surface Finish: Unglazed.

C. Glazed Wall Tile: ANSI A137.1 standard grade.
   1. Size: 4 x 13 inch (101 by 330 mm), nominal.
   2. Products:
      a. Dal-Tile Corporation; Modern Dimensions #0190 Arctic White: www.daltile.com/#sle.

D. Gauged Porcelain Tiles and Panels/Slabs: ANSI A137.3 standard grade.

1. Size: 12 inch by 24 inch, nominal.
2. Thickness: 3/8 inch (9.5 mm).
3. Products:
    a. Porcelanosa "Urbatek, Grupo Morse" www.porcelanosa-usa.com.

END OF SECTION

SECTION 093050
TILE SETTING MATERIALS AND ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Edge-protection and transition profiles for floors.

B. Finishing and edge-protection profiles for walls and countertops.

C. Movement joint and cove-shaped profiles.

D. Uncoupling membrane.

E. Waterproofing Membrane.

F. Drainage membranes.

1.02 RELATED SECTIONS

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

B. Section 09 30 00 - Tiling.

1.03 REFERENCES

A. CSA B79-08: Floor, Area, and Shower Drains, and Cleanouts for Residential Construction.

B. IAPMO IGC 195: Interim Guide Criteria for Floor Drain with Integrated Bonding Flange.

C. Tile Council of North America (TCNA) Handbook for Ceramic Tile Installation.

D. Terrazzo, Tile and Marble Association of Canada (TTMAC) Specification Guide 09300 Tile Installation Manual.

E. American National Standard Specifications for the installation of ceramic tile A108 / A118 / A136.1.

1.04 SUBMITTALS

A. Submit under provisions of Section 01 30 00.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

C. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) long, representing actual product, color, and finish.

D. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum five-years' experience.

B. Source Limitations for Setting Materials and Accessories: Obtain product of a uniform quality for each application condition from a single manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

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

B. Protect materials from exposure to moisture. Do not deliver until after wet work is complete and dry.

C. Store materials in a dry, warm, ventilated weathertight location.

1.07 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.08 COORDINATION

A. Coordinate Work with other operations and installation of floor finish materials to avoid damage to installed materials.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer: Schluter Systems, L.P., 194 Pleasant Ridge Road, Plattsburgh, NY 12901-5841. ASD. Tel: (800) 472-4588. Fax (800) 477-9783. E-mail:specassist@schluter.com. Web:www.schluter.com.

B. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00.

2.02 EDGE-PROTECTION AND TRANSITION PROFILES FOR FLOORS

A. 09.3050.01: Floor edge protection and transition profile, Schluter-SCHIENE; L-shaped.
   1. Description: L-shaped profile with 1/8 inch (3.2 mm) wide visible surface integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer.
   2. Anchoring Leg:
      a. Provide with straight anchoring leg.
      b. Provide with special radius anchoring leg for radius applications.
   3. Material and Finish:
      a. A - Aluminum.
         1) Height as required to coordinate with tile selection and setting system selected.

B. 09.3050.02: Floor edge protection and transition profile, Schluter-DECO; transition from tile to similar height floor coverings.
   1. Description: profile with 1/4 inch (6 mm) wide visible surface and integrated trapezoid-perforated anchoring leg.
   2. Anchoring Leg:
      a. Provide with straight anchoring leg.
      b. Provide with special radius anchoring leg for radius applications.
   3. Material and Finish:
      a. AE - Satin Anodized Aluminum.
         1) Height as required to coordinate with tile selection and setting system selected.

C. 09.3050.03: Floor edge protection and transition profile, Schluter-RENO-T; T type molding.
   1. Description: T-shaped profile with 1/16 inch (1 mm) thick beveled exposed surface and 11/32 inch (9 mm) tall integrated vertical anchoring leg.
   2. Material and Finish:
      a. AE - Satin Anodized Aluminum.
         1) Width as required.

D. 09.3050.04: Floor edge protection and transition profile, Schluter-RENO-TK
   1. Description: profile with sloped exposed surface, 1/4 inch (6 mm) deep channel below exposed surface, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer.
   2. Anchoring Leg:
      a. Provide with straight anchoring leg.
      b. Provide with special radius anchoring leg for radius applications.
   3. Material and Finish:
      a. AE - Satin Anodized Aluminum.
         1) Height as required to coordinate with tile selection and setting system selected.

E. 09.3050.05: Floor edge protection and transition profile, Schluter-RENO-U
   1. Description: profile with sloped exposed surface, 5/32 inch (4 mm) tall leading edge, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer.
   2. Material and Finish:
      a. AE - Satin Anodized Aluminum.
         1) Height as required to coordinate with tile selection and setting system selected.

F. 09.3050.06: Floor edge protection and transition profile, Schluter-RENO-RAMP-K

1. Description: anodized aluminum profile with textured, sloped exposed surface, tapered leading edge and integrated grout joint spacer.
2. Material and Finish:
   a. AE - Satin Anodized Aluminum.
3. Height: 1/2 inch (12.5 mm).
4. Ramp Length: 2-1/2 inch (64 mm)

G. 09.3050.01.07: Floor edge protection and transition profile, Schluter-RENO-RAMP
1. Description: anodized aluminum profile with textured, sloped exposed surface, tapered leading edge, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer.
2. Material and Finish:
   a. AE - Satin Anodized Aluminum.
3. Height as required.
4. Ramp Length: As required.

2.03 FINISHING AND EDGE-PROTECTION PROFILES FOR WALLS AND COUNTERTOPS

A. 09.3050.08: Finishing and edge protection profiles for walls and countertops, Schluter-SCHIENE; L shaped
1. Description: L-shaped profile with 1/8 inch (3.2) wide visible surface, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer.
2. Anchoring Leg:
   a. Provide with straight anchoring leg.
   b. Provide with special radius anchoring leg for radius applications.
3. Material and Finish:
   a. AE - Satin Anodized Aluminum.
      1) Height as required to coordinate with tile selection and setting system selected.

B. 09.3050.09: Finishing and edge protection profiles for walls and countertops, Schluter-QUADEC
1. Description: profile with square visible surface, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer.
2. Corners:
   a. Provide with matching inside corners.
   b. Provide with matching outside corners.
   c. Provide with internal connectors.
3. Material and Finish:
   a. AE - Satin Anodized Aluminum.
      1) Height as required to coordinate with tile selection and setting system selected.

C. 09.3050.10: Finishing and edge protection profiles for walls and countertops, Schluter-RONDEC-STEP
1. Description: anodized aluminum profile with flat exposed face, symmetrically-rounded exposed top surface with 1/4 inch (6 mm) radius, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer.
2. Corners:
   a. Provide with matching inside corners.
   b. Provide with matching outside corners.

2.04 FINISHING AND EDGE-PROTECTION PROFILES FOR STAIR NOSINGS

A. 09.3050.11: Finishing and edge protection profiles for stair nosings, Schluter-RONDEC-STEP
1. Description: anodized aluminum profile with flat exposed face, symmetrically rounded exposed top surface with 1/4 inch (6 mm) radius, integrated trapezoid-perforated anchoring leg, and integrated grout joint spacer.
2. Corners:
   a. Provide with matching inside corners.
   b. Provide with matching outside corners.

2.05 MOVEMENT JOINTS AND COVE-SHAPED PROFILES

A. 09.3050.12: Finishing and edge protection profiles for stair nosings, Schluter-DILEX-BWS
   1. Description: profile with integrated rigid, recycled PVC, trapezoid-perforated anchoring legs, connected by a 3/16 inch (5 mm) wide soft CPE movement zone that forms the visible surface.

B. 09.3050.13: Finishing and edge protection profiles for stair nosings, Schluter-DILEX-BWB
   1. Description: profile with integrated rigid, recycled PVC, trapezoid-perforated anchoring legs, connected by a 3/8 inch (10 mm) wide soft CPE movement zone that forms the visible surface.

C. 09.3050.14: Finishing and edge protection profiles for stair nosings, Schluter-DILEX-EKSB
   1. Description: profile with integrated roll-formed stainless steel with trapezoid-perforated anchoring legs, connected by a 1/4 inch (6 mm) wide thermoplastic rubber movement zone, which together form the visible surface.

D. 09.3050.15: Finishing and edge protection profiles for stair nosings, Schluter-DILEX-AS
   1. Description: profile with integrated rigid PVC trapezoid-perforated anchoring leg and a sloped flexible joining leg, with self-adhesive tape on the underside, which forms the visible surface.
   2. Corners:
      a. Provide with matching inside corners.
      b. Provide with matching end caps.

E. 09.3050.16: Finishing and edge protection profiles for stair nosings, Schluter-DILEX-HK
   1. Description: profile with integrated rigid, recycled PVC trapezoid-perforated anchoring legs, connected at a 90-degree angle by a soft CPE cove-shaped section with 11/16 inch (18 mm) radius that forms the visible surface.
   2. Corners:
      a. Provide with matching inside corners.
      b. Provide with matching outside corners.
      c. Provide with matching end caps.
      d. Provide with matching connectors.

F. 09.3050.17: Finishing and edge protection profiles for stair nosings, Schluter-DILEX-HKS
   1. Description: profile with integrated, roll-formed stainless steel with trapezoid-perforated anchoring legs, connected at a 90-degree angle by a stainless steel cove-shaped section with 23/32 inch (18.5 mm) radius and 1/2 inch (12.5 mm) wide thermoplastic rubber movement zone, which together form the visible surface.
   2. Corners:
      a. Provide with matching inside corners.
      b. Provide with matching outside corners.
      c. Provide with matching end caps.
      d. Provide with matching connectors.

2.06 UNCOUPLING MEMBRANE

A. 09.3050.18: Uncoupling membrane, Schluter-DITRA
   1. Description: 1/8 inch (3 mm) thick, orange, high-density polyethylene membrane with a grid structure of 1/2 inch by 1/2 inch (12 mm by 12 mm) square cavities, each cut back in a dovetail configuration, and a polypropylene anchoring fleece laminated to its underside. Conforms to definition for uncoupling membranes in the Tile Council of North America Handbook for Ceramic Tile Installation and is listed by cUPC to meet or exceed the requirements of the "American national standard specifications for load bearing, bonded, waterproof membranes for thin-set ceramic tile and dimension stone installation A118.10 and is listed by cUPC, and is evaluated by ICC-ES (see Report No. ESR-2467).
   2. Waterproofing seaming membrane:
      a. Provide KERDI BAND Seams and Corners material 0.004 inch (0.1 mm) thick, orange polyethylene membrane, with polypropylene fleece laminated on both sides.

2.07 WATERPROOFING MEMBRANE

A. 09.3050.22: Waterproofing Membrane Schluter-KERDI
   1. Description: 0.008 inch (0.2 mm) thick, orange polyethylene membrane, with polypropylene fleece laminated on both sides, which is listed by cUPC to meet or exceed requirements of the "American national standard specifications for load bearing, bonded, waterproof membranes for thin-set ceramic tile and dimension stone installation A118.10 and is listed by cUPC, and is evaluated by ICC-ES (see Report No. ESR-2467).
   2. Corners and seals:
      a. Provide matching preformed inside corners.
      b. Provide matching preformed outside corners.
      c. Provide matching preformed pipe seals.
      d. Provide matching preformed mixing valve seals.

2.08 WATERPROOF BUILDING PANEL FOR CERAMIC AND STONE TILE

A. 09.3051.23: Waterproof building panel for ceramic and stone tile; Schluter-KERDI-BOARD
   1. Description: Rigid extruded polystyrene foam building element panel, with reinforcement material and polypropylene fleece webbing laminated on both sides for thin-set ceramic tile and dimension stone Installations.
   2. Panel Thickness:
      a. Thickness as required.
   3. Panel Size:
      a. 48 inch by 96 inch (122 by 244 cm).

2.09 DRAINAGE MEMBRANES

A. 09.3050.24: Drainage membranes, Schluter-TROBA
   1. Description: orange polyethylene sheet with 3/32 inch (7 mm) tall trapezoid-shaped perforated studs that form vault-like cavities.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Engineer of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install uncoupling membrane under all floor tile, no exception.

3.04 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

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SECTION 095105
ACOUSTICAL CEILINGS (ARMSTRONG LAY IN")

PART 1 GENERAL

1.01 1.1 RELATED DOCUMENTS

A. Drawings and general conditions of Contract, including General and Supplementary Conditions and Divisions-1 Specification sections apply to work of this section.

1.02 SUMMARY

A. Section Includes
   1. Acoustical ceiling panels
   2. Exposed grid suspension system
   3. Wire hangers, fasteners, main runners, cross tees, and wall angle moldings
   4. Perimeter Trim

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. ASTM A 1008 Standard Specification for Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability
   2. ASTM A 641 Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
   3. ASTM A 653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
   4. ASTM C 423 Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
   5. ASTM C 635 Standard Specification for Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings
   6. ASTM C 636 Recommended Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels
   7. ASTM D 3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
   8. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials
   9. ASTM E 119 Standard Test Methods for Fire Tests of Building Construction and Material
      a. Armstrong Fire Guard Products
   10. ASTM E 580 Installation of Metal Suspension Systems in Areas Requiring Moderate Seismic Restraint
   11. ASTM E 1111 Standard Test Method for Measuring the Interzone Attenuation of Ceilings Systems
   12. ASTM E 1414 Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum
   13. ASTM E 1264 Classification for Acoustical Ceiling Products

B. International Building Code

C. ASHRAE Standard 62.1-2004, Ventilation for Acceptable Indoor Air Quality

D. NFPA 70 National Electrical Code

E. ASCE 7 American Society of Civil Engineers, Minimum Design Loads for Buildings and Other Structures

F. International Code Council-Evaluation Services - AC 156 Acceptance Criteria for Seismic Qualification Testing of Non-structural Components

G. International Code Council-Evaluation Services Report - Seismic Engineer Report
   1. ESR 1308 - Armstrong Suspension Systems

H. International Association of Plumbing and Mechanical Officials - Seismic Engineer Report
   1. 0244 - Armstrong Single Span Suspension System

I. California Department of Public Health CDPH/EHLB Emission Standard Method Version 1.1 2010

J. International Well Building Standard

K. Mindful Materials

L. Living Building Challenge

M. U.S. Department of Agriculture BioPreferred program (USDA BioPreferred).

1.04 SYSTEM DESCRIPTION

A. Continuous/Wall-to-Wall

1.05 SUBMITTALS

A. Product Data: Submit manufacturer's technical data for each type of acoustical ceiling unit and suspension system required.

B. Samples: Minimum 6 inch x 6 inch samples of specified acoustical panel; 8 inch long samples of exposed wall molding and suspension system, including main runner and 4 foot cross tees.

C. Shop Drawings: Layout and details of acoustical ceilings show locations of items that are to be coordinated with, or supported by the ceilings.

D. Acoustical Certifications: Manufacturer's certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards. For acoustical performance, each carton of material must carry an approved independent laboratory classification of NRC, CAC, and AC.

1. If the material supplied by the acoustical subcontractor does not have an Underwriter's Laboratory classification of acoustical performance on every carton, subcontractor shall be required to send material from every production run appearing on the job to an independent or NVLAP approved laboratory for testing, at the Engineer's or Owner's discretion. All products not conforming to manufacturer's current published values must be removed, disposed of and replaced with complying product at the expense of the Contractor performing the work.

1.06 QUALITY ASSURANCE

A. Single-Source Responsibility: Provide acoustical panel units and grid components by a single manufacturer.

1. Fire Performance Characteristics: Identify acoustical ceiling components with appropriate markings of applicable testing and inspecting organization.
2. Surface Burning Characteristics: As follows, tested per ASTM E 84 and complying with ASTM E 1264 Classification.
3. Fire Resistance: As follows tested per ASTM E119 and listed in the appropriate floor or roof design in the Underwriters Laboratories Fire Resistance Directory

B. Acoustical Panels: As with other architectural features located at the ceiling, may obstruct or skew the planned fire sprinkler water distribution pattern through possibly delay or accelerate the activation of the sprinkler or fire detection systems by channeling heat from a fire either toward or away from the device. Designers and installers are advised to consult a fire protection engineer, NFPA 13, or their local codes for guidance where automatic fire detection and suppression systems are present.

C. Coordination of Work: Coordinate acoustical ceiling work with installers of related work including, but not limited to building insulation, gypsum board, light fixtures, mechanical systems, electrical systems, and sprinklers.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver acoustical ceiling units to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical ceiling units, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical ceiling units carefully to avoid chipping edges or damaged units in any way.

1.08 PROJECT CONDITIONS

A. Space Enclosure:
   1. Standard Ceilings: Do not install interior ceilings until space is enclosed and weatherproof; wet work in place is completed and nominally dry; work above ceilings is complete; and ambient conditions of temperature and humidity are continuously maintained at values near those intended for final occupancy. Building areas to receive ceilings shall be free of construction dust and debris.
   2. HumiGuard Plus Ceilings: Building areas to receive ceilings shall be free of construction dust and debris. Products with HumiGuard Plus performance and hot dipped galvanized steel, aluminum or stainless steel suspension systems can be installed up to 120°F (49°C) and in spaces before the building is enclosed, where HVAC systems are cycled or not operating. Cannot be used in exterior applications where standing water is present or where moisture will come in direct contact with the ceiling.
   3. HumiGuard Max Ceilings: Building areas to receive ceilings shall be free of construction dust and debris. Ceilings with HumiGuard Max performance can be installed in conditions up to 120°F (49°C) and maximum humidity exposure including outdoor applications, and other standing water applications, so long as they are installed with either SS Prelude Plus, AL Prelude Plus, or Prelude Plus Fire Guard XL suspension systems. Products with Humiguard Max performance can be installed in exterior applications, where standing water is present, or where moisture will come in direct contact with the ceiling. Only Ceramaguard with AL Prelude Plus suspension system can be installed over swimming pools.

1.09 WARRANTY

A. ACOUSTICAL PANEL: SUBMIT A WRITTEN WARRANTY EXECUTED BY THE MANUFACTURER, AGREEING TO REPAIR OR REPLACE PANELS THAT FAIL WITHIN THE WARRANTY PERIOD. FAILURES INCLUDE, BUT ARE NOT LIMITED TO THE FOLLOWING:
   1. Acoustical Panels: Sagging and warping
   2. Grid System: Rusting and manufacturer's defects

B. Warranty Period:
   1. Acoustical panels: Ten (10) years from date of substantial completion
   2. Suspension: Ten (10) years from date of substantial completion
   3. Ceiling System: 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.

1.10 MAINTENANCE

A. Extra Materials: Deliver extra materials to Owner. Furnish extra materials described below that match products installed. Packaged with protective covering for storage and identified with appropriate labels.
   1. Acoustical Ceiling Units: Furnish quality of full-size units equal to 5.0 percent of amount installed.
   2. Exposed Suspension System Components: Furnish quantity of each exposed suspension component equal to 2.0 percent of amount installed.

PART 2 PRODUCTS

2.01 ACOUSTICAL CEILING ELEMENTS

A. (09.5105.05) Acoustical Panels ULTIMA Health Zone NRC; 24" x 24" Tegular.

B. (09.5105.06) Acoustical Panels Optima Health Zone PB; 24" x 24" Tegular.

C. (09.5105.50) Armstrong Suprafine XL 9/16" Exposed Tee Grid system.

D. (09.5105.51) Armstrong Prelude XL 15/16" Exposed Tee Grid system.

2.02 MANUFACTURERS

A. Ceiling Panels:
   1. Armstrong World Industries, Inc.
   2. Substitutions: Subject to the provisions of Section 01 1600 Product Requirements

B. Suspension Systems:
   1. Armstrong World Industries, Inc.
   2. Substitutions: Subject to the provisions of Section 01 1600 Product Requirements

C. Perimeter Systems
   1. Armstrong World Industries, Inc.
   2. Substitutions: Subject to the provisions of Section 01 1600 Product Requirements

2.03 ACOUSTICAL CEILING UNITS

A. (09.5105.05) Acoustical Panels ULTIMA Health Zone NRC
   1. Acoustical Panels Type AP
      a. Surface Texture: Fine
      b. Composition: Mineral Fiber
      c. Color: White
      d. Size: 24 in x 24 in
      e. Edge Profile: Beveled Tegular 15/16 in
      f. Edge Profile: for interface with Armstrong Prelude XL 15/16" Exposed Tee Grid system.
      g. Noise Reduction Coefficient (NRC): ASTM C 423; Classified with UL label on product carton 0.80
      h. Ceiling Attenuation Class (CAC): ASTM C 1414; Classified with UL label on product carton 35
      i. Sabin: N/A
      j. Articulation Class (AC):
      k. Flame Spread: ASTM E 1264; Class A (UL)
      l. Light Reflectance (LR) White Panel: ASTM E 1477; 0.86
      m. Dimensional Stability: HumiGuard Plus
      n. Recycle Content: Post-Consumer - 0% Pre-Consumer - 68%
      o. Material Ingredient Transparency: Health Product Declaration (HPD); Declare Label
      p. Life Cycle Assessment: Third Party Certified Environment Product Declaration (EPD)
      q. Acceptable Product: ULTIMA Health Zone High NRC, 1447 No added formaldehyde as manufactured by Armstrong World Industries

B. (09.5105.06) Acoustical Panels Optima Health Zone PB; 24" x 24" Tegular.
   1. Surface Texture: Fine
   2. Composition: Fiberglass
   3. Color: White
   4. Size: 24 in x 24 in
   5. Edge Profile: Beveled Tegular 15/16 in
   6. Edge Profile: for interface with Armstrong Prelude XL 15/16" Exposed Tee Grid system.
   7. Noise Reduction Coefficient(NRC): ASTM C 423; Classified with UL label on product carton 0.95
   8. Ceiling Attenuation Class (CAC) :
   9. Sabin:N/A
   10. Articulation Class (AC): ASTM E 1111; Classified with UL label on product carton 190
   11. Flame Spread: ASTM E 1264; Class A (UL)
   12. Light Reflectance (LR) White Panel: ASTM E 1477; 0.86
   13. Dimensional Stability: HumiGuard Plus
   14. Recycle Content: Post-Consumer - 12% Pre-Consumer - 59%
   15. Material Ingredient Transparency: Health Product Declaration (HPD); Declare Label
   16. Life Cycle Assessment: Third Party Certified Environment Product Declaration (EPD)

17. Acceptable Product: OPTIMA Health Zone, 3216PB No added formaldehyde as manufactured by Armstrong World Industries

2.04 METAL SUSPENSION SYSTEMS

A. Armstrong Prelude XL 15/16" Exposed Tee Grid system.
   1. Components:
      a. Main beams and cross tees, base metal and end detail, fabricated from commercial quality hot dipped galvanized steel complying with ASTM A 653. Main beams and cross tees are double-web steel construction with type exposed flange design. Exposed surfaces chemically cleansed, capping prefinished galvanized steel in baked polyester paint. Main beams and cross tees shall have rotary stitching.
      b. Structural Classification: ASTM C 635 Intermediate Duty duty
      c. Color: and match the actual color of the selected ceiling tile, unless noted otherwise.
      d. Sustainability: Environmental Product Declaration (EPD), Health Product Declaration (HPD)
      e. Acceptable Product: PRELUDE XL 15/16" Exposed Tee as manufactured by Armstrong World Industries
   2. Attachment Devices: Size for five times design load indicated in ASTM C 635, Table 1, Direct Hung unless otherwise indicated.
   3. Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft annealed, with a yield stress load of at least time three design load, but not less than 12 gauge.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not proceed with installation until all wet work such as concrete, terrazzo, plastering and painting has been completed and thoroughly dried out, unless expressly permitted by manufacturer's printed recommendations. (Exception: HumiGuard Max Ceilings)

3.02 PREPARATION

A. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less than half width units at borders and comply with reflected ceiling plans. Coordinate panel layout with mechanical and electrical fixtures.

B. Coordination: Furnish layouts for preset inserts, clips, and other ceiling anchors whose installation is specified in other sections.
   1. Furnish concrete inserts and similar devices to other trades for installation well in advance of time needed for coordination of other work.

3.03 INSTALLATION

A. Follow manufacturer installation instructions.

B. Install suspension system and panels in accordance with the manufacturer's instructions, and in compliance with ASTM C 636 and with the authorities having jurisdiction.

C. Suspend main beam from overhead construction with hanger wires spaced 4-0 on center along the length of the main runner. Install hanger wires plumb and straight.

D. Install wall moldings at intersection of suspended ceiling and vertical surfaces. Miter corners where wall moldings intersect or install corner caps.

E. For reveal edge panels: Cut and reveal or rabbet edges of ceiling panels at border areas and vertical surfaces.

F. Install acoustical panels in coordination with suspended system, with edges resting on flanges of main runner and cross tees. Cut and fit panels neatly against abutting surfaces. Support edges by wall moldings.

3.04 ADJUSTING AND CLEANING

A. Replace damaged and broken panels.

B. Clean exposed surfaces of acoustical ceilings, including trim, edge moldings, and suspension members. Comply with manufacturer's instructions for cleaning and touch up of

minor finish damage. Remove any ceiling products that cannot be successfully cleaned and or repaired. Replace with attic stock or new product to eliminate evidence of damage.

C. Before disposing of ceilings, contact the Armstrong Recycling Center at 877-276-7876, select option #1 then #8 to review with a consultant the condition and location of building where the ceilings will be removed. The consultant will verify the condition of the material and that it meets the Armstrong requirements for recycling. The Armstrong consultant with provide assistance to facilitate the recycle of the ceiling.

END OF SECTION

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SECTION 096500
RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Resilient tile flooring.

B. Static control resilient tile flooring.

C. Resilient base.

D. Resilient stair accessories.

E. Installation accessories.

1.02 RELATED REQUIREMENTS

A. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 033000 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied resilient flooring.

C. Section 090561 - Common Work Results for Flooring Preparation: Removal of existing floor coverings, cleaning, and preparation.

D. Section 260526 - Grounding and Bonding for Electrical Systems: Grounding and bonding of static control flooring to building grounding system.

1.03 REFERENCE STANDARDS

A. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile 2004 (Reapproved 2018).

B. ASTM F1861 - Standard Specification for Resilient Wall Base 2021.

C. ASTM F2195 - Standard Specification for Linoleum Floor Tile 2018.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

C. Shop Drawings: Indicate seaming plans and floor patterns.

D. Selection Samples: Submit manufacturer's complete set of color samples for Engineer's initial selection.

E. Verification Samples: Submit two samples, 12 by 12 inch ([___] by [___] mm) in size illustrating color and pattern for each resilient flooring product specified.

1.05 DELIVERY, STORAGE, AND HANDLING

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

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

C. Maintain temperature in storage area between 55 degrees F (13 degrees C) and 90 degrees F (72 degrees C).

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

E. Do not double stack pallets.

1.06 FIELD CONDITIONS

A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F (21 degrees C) to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F (13 degrees C).

PART 2 PRODUCTS

2.01 RESILIENT FLOORING ELEMENTS

A. (09.6500.03) Static control tile; Armstrong flooring; Excelon ESD, Static Control VCT; 1/8" x 12" x 12"

B. (09.6500.22) Vinyl composition tile; 1/8" x 12" x 12"

C. (09.6500.80) Resilient cove base

D. (09.6500.81) Resilient straight base

2.02 TILE FLOORING

A. Vinyl Composition Tile: Homogeneous, with color extending throughout thickness.
   1. Manufacturers:
      a. Armstrong Flooring, Inc; Standard Execelon Imperial Texture: www.armstrongflooring.com/#sle.
      b. Substitutions: See Section 016000 - Product Requirements.
   2. Minimum Requirements: Comply with ASTM F1066, of Class corresponding to type specified.
   3. Size: 12 by 12 inch (305 by 305 mm).
   4. Thickness: 0.125 inch (3.2 mm).
   5. Color: As indicated on drawings.

B. Static Control Tile: Homogeneous; color and pattern throughout thickness.
   1. (09.6500.03) Static control tile; Armstrong flooring; Excelon ESD, Static Control VCT; 1/8" x 12" x 12"
   2. Static Control Tile: Homogeneous; color and pattern throughout thickness.
      a. Manufacturers:
         1) Armstrong Flooring, Inc: www.armstrongflooring.com/#sle.
         2) Substitutions: See Section 016000 - Product Requirements.
      b. Minimum Requirements: Vinyl composition tile complying with ASTM F1066, Class 2.
      c. Electrical Resistance:
         1) Conductive Tile: Resistance between 25 kiloohms and 1.0 megohms as tested in accordance with ASTM F150.
         2) Dissipative Tile: Resistance between 1.0 megohms and 1000 megohms as tested in accordance with ASTM F150.
      d. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
      e. Tile Size: 12 by 12 inch.
      f. Total Thickness: 0.125 inch.
      g. Pattern: Excelon ESD, Static Control VCT.
      h. Color: Armor Gray.
      i. Grounding strips, adhesive and polish from Manufacturer and per manufacturers' specifications.

2.03 RESILIENT BASE

A. (09.6500.80) Resilient cove base

B. (09.6500.81) Resilient straight base

C. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset; top set Style B, Cove.
   1. Manufacturers:
      a. Johnsonite, a Tarkett Company: www.johnsonite.com.
      b. Armstrong; www.armstrongflooring.com.
   2. Height: 4 inch (100 mm).
   3. Thickness: 0.125 inch (3.2 mm).
   4. Length: 4 foot (1.2 m) sections.
   5. Color: As indicated on drawings.

2.04 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.

B. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.

C. Moldings, Transition and Edge Strips: Same material as flooring.

D. Copper Grounding Strips: Type and size as recommended by static control flooring manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.

B. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
   1. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

3.02 INSTALLATION - GENERAL

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install in accordance with manufacturer's written instructions.

C. Adhesive-Applied Installation:
   1. Spread only enough adhesive to permit installation of materials before initial set.
   2. Place copper grounding strip in conductive adhesive and apply additional adhesive to top side of strip before installing static control flooring. Allow strip to extend beyond flooring in accordance with static control flooring manufacturer's instructions. Refer to Section 260526 for grounding and bonding to building grounding system.
   3. Fit joints and butt seams tightly.
   4. Set flooring in place, press with heavy roller to attain full adhesion.

D. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.

E. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
   1. Resilient Strips: Attach to substrate using adhesive.

F. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

G. Install flooring in recessed floor access covers, maintaining floor pattern.

H. At movable partitions, install flooring under partitions without interrupting floor pattern.

I. Install feature strips where indicated.

3.03 INSTALLATION - TILE FLOORING

A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.

3.04 INSTALLATION - RESILIENT BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches (45 mm) between joints.

B. Install base on solid backing. Bond tightly to wall surfaces.

3.05 CLEANING

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

B. Clean in accordance with manufacturer's written instructions.

END OF SECTION

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SECTION 096813
TILE CARPETING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Walk off mat.

1.02 REFERENCE STANDARDS

A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials 2016 (Reapproved 2021).

B. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source 2019a, with Editorial Revision (2020).

C. ASTM E662 - Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials 2021a.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

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

C. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.

D. Submit two, 4 inch ([____] mm) long samples of edge strip and stair nosing.

E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

F. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in installing carpet tile with minimum three years documented experience and approved by carpet tile manufacturer.

1.05 FIELD CONDITIONS

A. Store materials in area of installation for minimum period of 24 hours prior to installation.

PART 2 PRODUCTS

2.01 TILE CARPETING ELEMENTS

A. (09.6813.02) Walk-off Modular Carpet Tiles; 20" x 20"; non woven diagonal ribbed.

2.02 MANUFACTURERS

A. Entrance Matting Systems
   1. Basis of design: Amarco Products; www.amarcoproducts.com

2.03 MATERIALS

A. (09.6813.02) Walk-off Modular Carpet Tiles; 20" x 20"; non woven diagonal ribbed.
   1. Marathon-Tile; non woven diagonal ribbed carpet tile
      a. 1/2" braided pattern
   2. Tile size: Nominal 20 by 20 inch (19.69 x 19.69 inch)
   3. Color: Charcoal
   4. Specific optical smoke and ignition compliance per ASTM E662, ASTM E648 and ASTM D2859 for floor coverings.
   5. Manufacturer: American Mat and Rubber Company, AMARCO; www.amarcoproducts.com

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive carpet tile.

C. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to subfloor surfaces.

D. Cementitious Subfloor Surfaces: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).

1. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.

3.02 PREPARATION

A. Remove subfloor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler.

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

C. Vacuum clean substrate.

3.03 INSTALLATION

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install carpet tile in accordance with manufacturer's instructions.

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

3.04 CLEANING

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

B. Clean and vacuum carpet surfaces.

END OF SECTION

SECTION 099113
EXTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
   1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
   2. Exposed surfaces of steel lintels and ledge angles.
   3. Mechanical and Electrical:
      a. On the roof and outdoors, paint equipment that is exposed to weather or to view, including factory-finished materials.

D. All exposed CMU to be painted with block filler.

E. Do Not Paint or Finish the Following Items:
   1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
   5. Floors, unless specifically indicated.
   6. Glass.
   7. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency current edition.

B. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials 2020.

C. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.

D. SSPC-SP 1 - Solvent Cleaning 2015, with Editorial Revision (2016).

E. SSPC-SP 6 - Commercial Blast Cleaning 2007.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
   2. Cross-reference to specified paint system(s) product is to be used in; include description of each system.

C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches (216 by 279 mm) in size, illustrating range of colors available for each finishing product specified.
   1. Where sheen is specified, submit samples in only that sheen.

D. Manufacturer's Instructions: Indicate special surface preparation procedures.

E. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.06 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 EXTERIOR PAINT SYSTEMS

A. (09.9113.00) Clear Water Repellant. concrete, masonry surfaces
   1. Paint System A --Weatherproof concrete and masonry surfaces.

B. (09.9113.01) Latex Paint Concrete, masonry -- walls and ceilings,
   1. Paint System B, C: Concrete; -- walls and ceilings, Poured Concrete, Precast Concrete, Unglazed Brick, Cement Board, Tilt-Up Concrete, Cast-in-Place Concrete including Plaster Walls and Ceilings.

C. (09.9113.02) Latex Paint Concrete, metal, structural and ornamental,
   1. Paint System D, G: Metal (Structural Steel Columns, Joists, Trusses, Beams, Miscellaneous and Ornamental Iron, Structural Iron, Ferrous Metal).

D. (09.9113.03) Latex paint all exposed block surfaces
   1. Paint System E, J: block filler and two finish coats latex

E. (09.9113.04) Exterior concrete sealer
   1. Paint System L: -- Exterior Concrete Sealer.

2.02 MANUFACTURERS

A. Provide paints and finishes from the same manufacturer to the greatest extent possible.
   1. Substitution of other products by the same manufacturer is preferred over substitution of products by a different manufacturer.

B. Paints:
   1. Diamond Vogel Paints; [_____]: www.diamondvogel.com/#sle.
   2. Dow Chemical Company: consumer.dow.com/en-us/industry/ind-building-construction.html/#sle.
   3. PPG Paints; [_____]: www.ppgpaints.com/#sle.
   4. Sherwin-Williams Company; [_____]: www.sherwin-williams.com/#sle.

C. Primer Sealers: Same manufacturer as top coats.

D. Substitutions: See Section 016000 - Product Requirements.

2.03 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready mixed, unless required to be a field-catalyzed paint.
   1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
   2. Supply each paint material in quantity required to complete entire project's work from a single production run.
   3. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Volatile Organic Compound (VOC) Content:

1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
   a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

2.04 MATERIALS LIST (NOTE: ALL ITEMS MIGHT NOT BE USED IN THIS PROJECT):

A. Paint Code Material:

A	Loxon 7% Siloxane Water Repellant (A10T7)
B	Pro Industrial Zero VOC Acrylic Coating Gloss (B66-600 series)
C	Pro Industrial Zero VOC Acrylic Coating Semi-Gloss (B66-650 series)
D	Pro Industrial Pro-Cryl Universal Metal Primer (B66-310)
E	Loxon Block Surfacer (A24-W200)
F	Benjamin Moore Ultra Spec 500 Interior Primer
G	Pro Industrial Pro-Cryl Universal Metal Primer (B66-310)
H	Traffic Marking Paint (Refer to Division 32, Exterior Improvements)
I	Sher-Cryl High Performance Acrylic Gloss (B66-300 series)
J	ProBlock Latex Primer/Sealer (B51W20)
K	Floor Stripe Paint (by others, part of Equipment Package)
L	Exterior Concrete Sealer, Koester VAPI 20000
M	VersaFlex WBG 250
N	Waterborne Acrylic Dryfall Egg-shell (B42-W2)
O	Progreen 200 Interior Latex Semi-Gloss (B31W651 series)
P	Manufacturer's Standard Recommended Finish(es)
Q	Pre-Catalyzed (one component) Water-Based Epoxy
R	Benjamin Moore Ultra Spec Scuff-X 485 Eggshell finish
S	Benjamin Moore Ultra Spec Scuff-X 485 Semi-gloss finish

B. Exterior Surfaces:

	Surface	1st coat	2nd coat	3rd coat
1	Ferrous Metals (Shop Coat)	G1	I	I
2	Galvanized Metal	D	I	I
3	Asphalt Paving Striping (Refer to Division 32)			
4	Pre-Engineered Building, Door channels & frames	G1	I	I
5	Exterior Piping	G	I	I
6	Concrete Masonry Units (common smooth face)	2	A	A
7	Exposed reinforced concrete (grade beams, foundations)	--	--	--
8	Fiber cement board	P	P	P
9	Pre-Engineered Metal Building canopy structural steel	G1	B,C	B,C
10	Exterior concrete surfaces (drives, walks, ramps, etc.)	L	L	--

1. Note 1: Shopcoat is by others
2. Note 2: Topical treatment of the CMU is in addition to the water repellent admixture integral to both the CMU and mortar

C. **Paint System A** -- Clear Water Repellant
1. Basis of Design: Sherwin Williams: www.sherwin-williams.com
   a. Loxon 7% Siloxane Water Repellant A10T00007
2. Description:
   a. Loxon 7% Siloxane Water Repellant is a clear siloxane water repellent designed to weatherproof old and new concrete and masonry against nature' s destructive

forces, providing a long lasting, breath- able barrier which exhibits superior resistance to water, airborne dust and dirt, salt, acid rain, efflorescence, alkali, freeze/thaw damage and spalling.

b. Do not use on asphalt surfaces. Not for immersion service.

c. Color: Clear

3. Coverage sq ft/gal

a. Smooth precast concrete 125-175

b. Porous concrete 100-150

c. Split face block 50-75

d. Fluted Block 25-50

e. Concrete Block 75-125

f. Brick (Clay) 100-150

g. Bridge decks 100-150

h. Steel troweled concrete 150-200

4. Coverage will vary depending on the porosity and texture of the substrate.

5. Drying Time, @ 77°F, 50% RH:

a. Temperature and humidity dependent Touch: 3 hours

D. **Paint System B, C**: Concrete -- Walls and Ceilings, Poured Concrete, Precast Concrete, Unglazed Brick, Cement Board, Tilt-Up Concrete, Cast-in-Place Concrete including Plaster Walls and Ceilings.

1. Basis of Design: Sherwin Williams: www.sherwin-williams.com

a. S-W Pro Industrial Acrylic Coating

1) Gloss: B66-600 Series

2) Semi-Gloss: B66-650 Series

2. Latex Systems:

a. Gloss Finish High Performance:

1) 1st Coat: S-W Loxon Concrete & Masonry Primer Sealer, A24W8300 (8 mils wet, 3.2 mils dry).

2) 2nd Coat: S-W Pro Industrial Gloss Acrylic Coating, B66-600 Series.

3) 3rd Coat: S-W Pro Industrial Gloss Acrylic Coating, B66-600 Series (6.0 mils wet, 2.5 mils dry per coat).

3. Latex Systems:

a. Semi-Gloss Finish High Performance:

1) 1st Coat: S-W Loxon Concrete & Masonry Primer Sealer, A24W8300 (8 mils wet, 3.2 mils dry).

2) 2nd Coat: S-W Pro Industrial Semi-Gloss Acrylic Coating, B66-650 Series.

3) 3rd Coat: S-W Pro Industrial Semi-Gloss Acrylic Coating, B66-650 Series (6.0 mils wet, 2.5 mils dry per coat)

E. **Paint System D, G**: Metal (Structural Steel Columns, Joists, Trusses, Beams, Miscellaneous and Ornamental Iron, Structural Iron, Ferrous Metal).

1. Basis of Design: Sherwin Williams: www.sherwin-williams.com

a. S-W Pro Industrial Acrylic Coating

2. Latex Systems:

a. Gloss Finish High Performance:

1) 1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-1310 Series (5.0 mils wet, 2.0 mils dry).

2) 2nd Coat: S-W Pro Industrial DTM Acrylic Gloss, B66 Series.

3) 3rd Coat: S-W Pro Industrial DTM Acrylic Gloss, B66 Series (6-10 mils wet, 2.5-4.0 mils dry per coat).

b. Semi-Gloss Finish:

1) 1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-1310 Series (5.0 mils wet, 2.0 mils dry).

2) 2nd Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series.

3) 3rd Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series (4.0 mils wet, 1.6 mils dry per coat).

c. Semi-Gloss Finish High Performance:

1) 1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-1310 Series (5.0 mils wet, 2.0 mils dry).
2) 2nd Coat: S-W Pro Industrial DTM Acrylic Semi-Gloss, B66 Series.
3) 3rd Coat: S-W Pro Industrial DTM Acrylic Semi-Gloss, B66 Series (6-10 mils wet, 2.5-4.0 mils dry per coat).

d. Egg-Shell / Satin Finish:
1) 1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-1310 Series (5.0 mils wet, 2.0 mils dry).
2) 2nd Coat: S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series.
3) 3rd Coat: S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series

F. **Paint System E, J:** Block.
1. Basis of Design: Sherwin Williams: www.sherwin-williams.com
   a. S-W Loxon Block Surfacer
   b. S-W Primer Sealer B51 Series
2. Egg-Shell Finish, Microbicidal Paint:
   a. 1st Coat: S-W Loxon Block Surfacer, A24W200(50-100 sq ft/gal).
   b. 2nd Coat: S-W Paint Shield Microbicidal Paint, D12W51 (4 mils wet, 1.8 mils dry per coat).
   c. 3rd Coat: S-W Paint Shield Microbicidal Paint, D12W51 (4 mils wet, 1.8 mils dry per coat).
3. Egg-Shell Finish, Microbicidal Paint:
   a. 1st Coat: S-W PrepRite ProBlock Latex Primer/Sealer, B51 Series (4 mils wet, 1.4 mils dry per coat).
   b. 2nd Coat: S-W Paint Shield Microbicidal Paint, D12W51 (4 mils wet, 1.8 mils dry per coat).
   c. 3rd Coat: S-W Paint Shield Microbicidal Paint, D12W51 (4 mils wet, 1.8 mils dry per coat).

G. **Paint System L:** -- Exterior Concrete Sealer.
1. Basis of Design: Moisture vapor control system shall be the product of a single manufacturer: KOSTER VAP I\loch\af1\dbch\af1\hich\f1\'ae\hich\af1\dbch\af1\loch\f1 2000 System by:
   a. KOSTER American Corporation
   b. Corporate Headquarters: 2585 Aviator Drive, Virginia Beach, VA 23453 Phone: (757) 425-1206 - Fax: (757) 425-9951
   c. Web address: www.kosterusa.com
2. Substitutions: See Section 01 6000 - Product Requirements.
3. General: Use materials of one manufacturer throughout the project as hereinafter specified.
4. Moisture Vapor Control Coating: Select from among the following products
   a. KOSTER VAP I® 2000 12 hour setting time, low VOC, 2-part epoxy resin coating.
   b. KOSTER VAP I® 2000 FS 4 - 5 hour setting time, Zero VOC. 2-part epoxy resin coating
   c. KOSTER VAP I® 2000 UFS 3 - 4 hour setting time, low VOC, 2-part epoxy resin
      1) coating
   d. KOSTER VAP I® 2000 ZERO VOC 12 hour setting time, Zero VOC, 2-part epoxy resin coating
5. Primer for underlayment:
   a. KOSTER VAP I® 06 Primer - non-porous substrate primer for use on VAP I® 2000 resin coating
6. Self-Leveling underlayment: Select from among the following products
   a. KOSTER SL
   b. KOSTER SL Premium
   c. KOSTER SC
7. Primer for porous concrete containing excessive near-surface voids or high concrete surface profile
   a. KOSTER KB-Pox IN, low viscosity, high modulus, 2-part epoxy resin
8. Repair resin for non-movement joints and cracks

a. KOSTER KB-Pox IN low-viscosity, high modulus 2-part epoxy gravity-feed, crack injection resin

9. Thickening agent for repairing spalls and excessively rough concrete
   a. KOSTER TA fiber thickening agent, non-silica
10. Movement joint sealant
   a. KOSTER FS-H polysulfide resin joint sealant
   b. Backer rod and accessory materials

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.

C. Test shop-applied primer for compatibility with subsequent cover materials.

D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
   1. Fiber Cement Siding: 12 percent.
   2. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.
   3. Concrete Floors and Traffic Surfaces: 8 percent.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.

D. Seal surfaces that might cause bleed through or staining of topcoat.

E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

F. Masonry:
   1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
   2. Prepare surface as recommended by top coat manufacturer.
   3. Clean surfaces with pressurized water. Use pressure range of 600 to 1,500 psi (4,140 to 10,350 kPa) at 6 to 12 inches (150 to 300 mm). Allow to dry.

G. Fiber Cement Siding: Remove dirt, dust and other foreign matter with a stiff fiber brush. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.

H. Concrete Floors and Traffic Surfaces: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.

I. Ferrous Metal:
   1. Solvent clean according to SSPC-SP 1.
   2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
   3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

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

K. Glue-Laminated Beams: Prior to finishing, wash surfaces with solvent, remove grease and dirt.

L. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Exterior Wood to Receive Opaque Finish: If final painting must be delayed more than 2 weeks after installation of woodwork, apply primer within 2 weeks and final coating within 4 weeks.

C. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

E. Apply each coat to uniform appearance.

F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

G. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

END OF SECTION

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SECTION 099123
INTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
   1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.

D. Do Not Paint or Finish the Following Items:
   1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
   5. Floors, unless specifically indicated.
   6. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
   2. MPI product number (e.g. MPI #47).
   3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.

C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches (216 by 279 mm) in size, illustrating range of colors available for each finishing product specified.
   1. Where sheen is specified, submit samples in only that sheen.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.06 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 INTERIOR PAINTING SYSTEMS

A. (09.9123.00) Interior Clear Water Repellant. concrete, masonry surfaces
   1. Paint System A --Weatherproof concrete and masonry surfaces.

B. (09.9123.01) Interior Latex Paint Concrete, masonry -- walls and ceilings,
   1. Paint System B, C: Concrete; -- walls and ceilings, Poured Concrete, Precast Concrete, Unglazed Brick, Cement Board, Tilt-Up Concrete, Cast-in-Place Concrete including Plaster Walls and Ceilings.

C. (09.9123.02) Interior Latex Paint Concrete, metal, structural and ornamental,
   1. Paint System D, G: Metal (Structural Steel Columns, Joists, Trusses, Beams, Miscellaneous and Ornamental Iron, Structural Iron, Ferrous Metal).

D. (09.9123.03) Interior Latex paint all exposed block surfaces
   1. Paint System E, J: block filler and two finish coats latex

E. (09.9123.04) Interior latex drywall paint
   1. Paint System F, R, S: drywall systems; primer and two finish coats.

F. (09.9123.05) Interior catalyzed epoxy finish
   1. Paint System Q: Catalyzed Epoxy

G. (09.9123.06) Interior Polyurea paint system, concrete floors.

2.02 MANUFACTURERS

A. Provide paints and finishes from the same manufacturer to the greatest extent possible.
   1. In the event that a single manufacturer cannot provide specified products, minor exceptions will be permitted provided approval by Engineer is obtained using the specified procedures for substitutions.

B. Paints:

2.03 MATERIALS LIST (NOTE: ALL ITEMS MIGHT NOT BE USED IN THIS PROJECT):

A. **Paint Code Material:**

A	Loxon 7% Siloxane Water Repellant (A10T7)
B	Pro Industrial Zero VOC Acrylic Coating Gloss (B66-600 series)
C	Pro Industrial Zero VOC Acrylic Coating Semi-Gloss (B66-650 series)
D	Pro Industrial Pro-Cryl Universal Metal Primer (B66-310)
E	Loxon Block Surfacer (A24-W200)
F	Benjamin Moore Ultra Spec 500 Interior Primer
G	Pro Industrial Pro-Cryl Universal Metal Primer (B66-310)
H	Traffic Marking Paint (Refer to Division 32, Exterior Improvements)
I	Sher-Cryl High Performance Acrylic Gloss (B66-300 series)
J	ProBlock Latex Primer/Sealer (B51W20)
K	Floor Stripe Paint (by others, part of Equipment Package)
L	Exterior Concrete Sealer, Koester VAPI 20000
M	VersaFlex WBG 250
N	Waterborne Acrylic Dryfall Egg-shell (B42-W2)
O	Progreen 200 Interior Latex Semi-Gloss (B31W651 series)
P	Manufacturer's Standard Recommended Finish(es)
Q	Pre-Catalyzed (one component) Water-Based Epoxy
R	Benjamin Moore Ultra Spec Scuff-X 485 Eggshell finish
S	Benjamin Moore Ultra Spec Scuff-X 485 Semi-gloss finish

B. **Interior Surfaces:**

	Surface	1st coat	2nd coat	3rd coat
1	Ferrous metal	G1	I	I

2	Galvanized metals	D	I	I
3	Concrete masonry units, painted, latex enamel	E	N	N
4	Gypsum Board	F	R	R
5	Wood moulding, wainscot system	J	S	S
6	Plywood liner panels	J2	-	-
7	Ferrous metals, Pre-Engineered Metal Building structural steel	G5	-	-
8	Exposed piping, tubes and conduits (note #3)	D	I	I
9	Concrete floor	M	M	-
10	Gypsum board at toilet rooms	F	Q	Q
11	Gypsum board at janitor rooms	F	Q	Q
12	Liner panel (interior)	J	-	-
13	Miscellaneous mounting boards	J	C	C

1. Note #1: Shop coat by others
2. Note #2: Prime both sides
3. Note #3: In finished areas
4. Note #4: By others
5. Note #5: Pre-engineered Metal Building Manufacturer's standard shop coat system

C. **Paint System A** -- Clear Water Repellant
   1. Basis of Design: Sherwin Williams: www.sherwin-williams.com
      a. Loxon 7% Siloxane Water Repellant A10T00007
   2. Description:
      a. Loxon 7% Siloxane Water Repellant is a clear siloxane water repellent designed to weatherproof old and new concrete and masonry against nature' s destructive forces, providing a long lasting, breath- able barrier which exhibits superior resistance to water, airborne dust and dirt, salt, acid rain, efflorescence, alkali, freeze/thaw damage and spalling.
      b. Do not use on asphalt surfaces. Not for immersion service.
      c. Color: Clear
   3. Coverage sq ft/gal
      a. Smooth precast concrete 125-175
      b. Porous concrete 100-150
      c. Split face block 50-75
      d. Fluted Block 25-50
      e. Concrete Block 75-125
      f. Brick (Clay) 100-150
      g. Bridge decks 100-150
      h. Steel troweled concrete 150-200
   4. Coverage will vary depending on the porosity and texture of the substrate.
   5. Drying Time, @ 77°F, 50% RH:
      a. Temperature and humidity dependent Touch: 3 hours

D. **Paint System B, C**: Concrete -- Walls and Ceilings, Poured Concrete, Precast Concrete, Unglazed Brick, Cement Board, Tilt-Up Concrete, Cast-in-Place Concrete including Plaster Walls and Ceilings.
   1. Basis of Design: Sherwin Williams: www.sherwin-williams.com
      a. S-W Pro Industrial Acrylic Coating
         1) Gloss: B66-600 Series
         2) Semi-Gloss: B66-650 Series
   2. Latex Systems:
      a. Gloss Finish High Performance:
         1) 1st Coat: S-W Loxon Concrete & Masonry Primer Sealer, A24W8300 (8 mils wet, 3.2 mils dry).
         2) 2nd Coat: S-W Pro Industrial Gloss Acrylic Coating, B66-600 Series.

3) 3rd Coat: S-W Pro Industrial Gloss Acrylic Coating, B66-600 Series (6.0 mils wet, 2.5 mils dry per coat).

3. Latex Systems:
   a. Semi-Gloss Finish High Performance:
      1) 1st Coat: S-W Loxon Concrete & Masonry Primer Sealer, A24W8300 (8 mils wet, 3.2 mils dry).
      2) 2nd Coat: S-W Pro Industrial Semi-Gloss Acrylic Coating, B66-650 Series.
      3) 3rd Coat: S-W Pro Industrial Semi-Gloss Acrylic Coating, B66-650 Series (6.0 mils wet, 2.5 mils dry per coat)

E. **Paint System D, G**: Metal (Structural Steel Columns, Joists, Trusses, Beams, Miscellaneous and Ornamental Iron, Structural Iron, Ferrous Metal; Hollow Metal Doors and Frames).
   1. Basis of Design: Sherwin Williams: www.sherwin-williams.com
      a. S-W Pro Industrial Acrylic Coating
   2. Latex Systems:
      a. Gloss Finish High Performance:
         1) 1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-1310 Series (5.0 mils wet, 2.0 mils dry).
         2) 2nd Coat: S-W Pro Industrial DTM Acrylic Gloss, B66 Series.
         3) 3rd Coat: S-W Pro Industrial DTM Acrylic Gloss, B66 Series (6-10 mils wet, 2.5-4.0 mils dry per coat).
      b. Semi-Gloss Finish:
         1) 1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-1310 Series (5.0 mils wet, 2.0 mils dry).
         2) 2nd Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series.
         3) 3rd Coat: S-W ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series (4.0 mils wet, 1.6 mils dry per coat).
      c. Semi-Gloss Finish High Performance:
         1) 1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-1310 Series (5.0 mils wet, 2.0 mils dry).
         2) 2nd Coat: S-W Pro Industrial DTM Acrylic Semi-Gloss, B66 Series.
         3) 3rd Coat: S-W Pro Industrial DTM Acrylic Semi-Gloss, B66 Series (6-10 mils wet, 2.5-4.0 mils dry per coat).
      d. Egg-Shell / Satin Finish:
         1) 1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-1310 Series (5.0 mils wet, 2.0 mils dry).
         2) 2nd Coat: S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series.
         3) 3rd Coat: S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series

F. **Paint System E, J:** Block.
   1. Basis of Design: Sherwin Williams: www.sherwin-williams.com
      a. S-W Loxon Block Surfacer
      b. S-W Primer Sealer B51 Series
   2. Egg-Shell Finish, Microbicidal Paint:
      a. 1st Coat: S-W Loxon Block Surfacer, A24W200(50-100 sq ft/gal).
      b. 2nd Coat: S-W Paint Shield Microbicidal Paint, D12W51 (4 mils wet, 1.8 mils dry per coat).
      c. 3rd Coat: S-W Paint Shield Microbicidal Paint, D12W51 (4 mils wet, 1.8 mils dry per coat).
   3. Egg-Shell Finish, Microbicidal Paint:
      a. 1st Coat: S-W PrepRite ProBlock Latex Primer/Sealer, B51 Series (4 mils wet, 1.4 mils dry per coat).
      b. 2nd Coat: S-W Paint Shield Microbicidal Paint, D12W51 (4 mils wet, 1.8 mils dry per coat).
      c. 3rd Coat: S-W Paint Shield Microbicidal Paint, D12W51 (4 mils wet, 1.8 mils dry per coat).

G. **Paint System L: -- See section 09 9113 -- Exterior Painting**.

H. **Paint System M: Concrete Floors**

1. Basis of Design: VersaFlex Companies
   a. Acceptable Manufacturer: VersaFlex; www.versaflex.com
2. VersaFlex WBG250, 2 coats.

I. **Paint System F, R, S: Drywall Systems.**
1. Basis of Design: Benjamin Moore and Co.
   a. Acceptable Manufacturer: Benjamin Moore and Co., which is located at: 101 Paragon Dr Montvale, NJ 07645; Toll Free Tel: 866-708-9181; Email: info@benjaminmoore.com; Web:www.benjaminmoore.com
2. Primer, Scrubbable matte, eggshell and semi-gloss
   a. 1st Coat: Benjamin Moore Interior Ultra Primer N534, 0 g/L, 50, 50 X-Green, 149, 149 X-Green,
   b. 2nd Coat: Benjamin Moore Interior Scuff-Interior Matte (484) Finish or Interior Eggshell Finish (485) or Interior Satin (486) Finish 88.4 g/L
   c. 3rd Coat: Benjamin Moore Interior Scuff-Interior Matte (484) Finish or Interior Eggshell Finish (485) or Interior Satin (486) Finish 88.4 g/L

J. **Paint System Q: Catalyzed Epoxy**
1. Basis of Design: Sherwin Williams: www.sherwin-williams.com
   a. S-W Pro Waterbased Catalyzed Epoxy
2. Epoxy Systems (Water Based):
   a. Gloss Finish:
      1) 1st Coat: S-W Waterbased Catalyzed Epoxy, B70W211/ B60V15.
      2) 2nd Coat: S-W Waterbased Catalyzed Epoxy, B70W211/ B60V15 (6 mils wet,2.5 mils dry per coat).
   b. Gloss Finish:
      1) 1st Coat: S-W Pro Industrial Water Based Catalyzed Epoxy, B73-300 Series.
      2) 2nd Coat: S-W Pro Industrial Water Based Catalyzed Epoxy, B73-300 Series (5 mils wet, 2.0 mils dry per coat).
   c. Semi-Gloss Finish:
      1) 1st Coat: S-W Waterbased Catalyzed Epoxy, B70W211/ B60V25.
      2) 2nd Coat: S-W Waterbased Catalyzed Epoxy, B70W211/ B60V25 (6 mils wet, 2.5 mils dry per coat).
   d. Semi-Gloss Finish:
      1) 1st Coat: S-W Loxon Concrete & Masonry Primer Sealer, A24W8300 (8 mils wet, 3.2 mils dry).
      2) 2nd Coat: S-W Pro Industrial Pre-Catalyzed Waterbased Epoxy, K46-Series.
      3) 3rd Coat: S-W Pro Industrial Pre-Catalyzed Waterbased Epoxy, K46- Series (4 mils wet, 1.5 mils dry per coat).
   e. Egg-Shel/Low Luster Finish:
      1) 1st Coat: S-W Loxon Concrete & Masonry Primer Sealer, A24W8300 (8 mils wet, 3.2 mils dry).
      2) 2nd Coat: S-W Pro Industrial Pre-Catalyzed Waterbased Epoxy, K45-Series.
      3) 3rd Coat: S-W Pro Industrial Pre-Catalyzed Waterbased Epoxy, K45- Series (4 mils wet, 1.5 mils dry per coat).
   f. Egg-Shel/Low Luster Finish:
      1) 1st Coat: S-W Pro Industrial Water Based Catalyzed Epoxy, B73-360 Series.
      2) 2nd Coat: S-W Pro Industrial Water Based Catalyzed Epoxy, B73-360 Series (5 mils wet, 2.0 mils dry per coat).

2.04 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready mixed, unless intended to be a field-catalyzed paint.
1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
2. Supply each paint material in quantity required to complete entire project's work from a single production run.

3. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

D. Seal surfaces that might cause bleed through or staining of topcoat.

3.02 APPLICATION

A. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

C. Apply each coat to uniform appearance in thicknesses specified by manufacturer.

D. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

E. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

END OF SECTION

SECTION 101102
TV / VIDEO MONITOR MOUNTING SYSTEM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Coordination

1.02 COORDINATION

A. The Contractor shall have the responsibility to coordinate and schedule and the Work. The Contractor shall be responsible for adhering to the schedule and coordinating submittals and installation of the work of the various Sections of specifications to assure efficient and orderly sequence of installation of interdependent construction elements.

1.03 SECTION INCLUDES

A. TV and Video Monitor mounting brackets.

1.04 RELATED REQUIREMENTS

A. Section 013000 - Administrative Requirements: Submittal procedures, project meetings, progress schedules and documentation, reports, coordination.

1.05 REFERENCE STANDARDS

A. VESA - Video Electronics Standards Association

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.

1.06 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide Manufacturer's product information and installation instructions.

C. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver mounting brackets to project site in manufacturer's original packaging material.

B. Store mounting brackets under cover and elevated above grade.

1.08 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of design: Peerless Industries, Inc.: www.peerless-av.com

B. Displays2go; www.displays2go.com .

C. Omni Mount; www.omnimount.com.

D. Substitutions: See Section 016000 - Product Requirements.

2.02 MATERIALS

A. (10.1102.04) TV Mount; universal tilt wall type for 39" to 75" Displays: Peerless Model #ST650P

B. Color: manufacturer's standard black.

C. Tilt Mount TV Mount
   1. Slim Profile
   2. Tilt: minimum15 degrees
   3. Size: large fit up to 96" TV

D. Blocking
   1. Provide blocking at each mounting location capable of supporting up to 200 lbs.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Mounting Heights.
   1. Open wall: 54" - 72" from finish floor to center of monitor viewing area.
   2. Mounting above desks, shelving, credenzas: Minimum 8" above surface to bottom of monitor.
   3. Verify all locations and mounting heights with owner.

3.02 CLEANING

A. Clean walls of all markings and dirt created by install. Dispose of all packing materials in approved containers; leave flooring clean and in 'move in' condition.

3.03 CLOSEOUT ACTIVITIES

A. Demonstrate proper operation of equipment to Owner's designated representative.

END OF SECTION

SECTION 101400
SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Room and door signs.

B. Interior directional and informational signs.

C. Emergency evacuation maps.

D. Building identification signs.

1.02 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines current edition.

B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.

C. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.

C. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
   1. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
   2. When content of signs is indicated to be determined later, request such information from Owner through Engineer at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
   3. Submit for approval by Owner through Engineer prior to fabrication.

D. Samples: Submit two samples of each type of sign, of size similar to that required for project, illustrating sign style, font, and method of attachment.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Package signs as required to prevent damage before installation.

B. Package room and door signs in sequential order of installation, labeled by floor or building.

C. Store tape adhesive at normal room temperature.

1.05 FIELD CONDITIONS

A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.

B. Maintain this minimum temperature during and after installation of signs.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Flat Signs:
   1. Best Sign Systems, Inc: www.bestsigns.com/#sle.
   2. Cosco Industries (ADA signs); ADA Series 1: www.coscoarchitecturalsigns.com/#sle.
   3. Mohawk Sign Systems, Inc: www.mohawksign.com/#sle.
   4. Seton Identification Products: www.seton.com/aec/#sle.
   5. Substitutions: See Section 016000 - Product Requirements.

B. Curved Signs:

2.02 SIGNAGE APPLICATIONS

A. Accessibility Compliance: Signs are required to comply with ADA Standards and ICC A117.1and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.

B. (10.1400.01) Room and Door Signs; provide a sign for every doorway, whether it has a door or not, not including corridors, lobbies, and similar open areas.
   1. Sign Type: Flat signs with engraved panel media as specified.
   2. Provide "tactile" signage, with letters raised minimum 1/32 inch (0.8 mm) and Grade II braille.
   3. Character Height: 1 inch (25 mm).
   4. Sign Height: 2 inches (50 mm), unless otherwise indicated.
   5. Office Doors: Identify with room names and numbers to be determined later, not those indicated on drawings.
   6. Conference and Meeting Rooms: Identify with room numbers to be determined later, not the numbers indicated on drawings.
   7. Service Rooms: Identify with room names and numbers to be determined later, not those indicated on drawings.
   8. Rest Rooms: Identify with pictograms, the names "MEN" and "WOMEN", room numbers to be determined later, and braille.

C. (10.1400.02) Interior directional and informational signs.
   1. Sign Type: Same as room and door signs.
   2. Sign Type: Curved signs with engraved panel media as specified.
   3. Sizes: As indicated on drawings.

D. (10.1400.03) Emergency evacuation maps
   1. Allow for one map per elevator lobby.
   2. Map content to be provided by Owner.
   3. Use clear plastic panel silk-screened on reverse, in brushed aluminum frame, screw-mounted.

2.03 SIGN TYPES

A. Flat Signs: Signage media without frame.
   1. Edges: Square.
   2. Corners: Square.
   3. Wall Mounting of One-Sided Signs: Tape adhesive.

B. Radius / Curved Signs: One-piece, curved extruded aluminum media holder securing flat, flexible sign media by curved lip on two sides; other two sides closed by end caps; concealed mounting attachment.
   1. Sizes: As indicated on drawings.
   2. Finish: Natural (clear) anodized.
   3. Sign Orientation: Curved in horizontal section.
   4. Wall Mounting of One-Sided Signs: Mechanical anchorage, with predrilled holes, and set in clear silicone sealant.

C. Color and Font: Unless otherwise indicated:
   1. Character Font: Helvetica, Arial, or other sans serif font.
   2. Character Case: Upper case only.
   3. Background Color: Black.
   4. Character Color: white color.

2.04 TACTILE SIGNAGE MEDIA

A. Engraved Panels: Laminated colored plastic; engraved through face to expose core as background color:
   1. Total Thickness: 1/16 inch (1.6 mm).

2.05 NON-TACTILE SIGNAGE MEDIA

A. Silk Screened Plastic Panels: Letters and graphics silk screened onto reverse side of plastic surface:
   1. Sign Color: Color as selected.

2. Total Thickness: 1/8 inch (3 mm).

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install neatly, with horizontal edges level.

C. Locate signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.

D. Protect from damage until Substantial Completion; repair or replace damaged items.

END OF SECTION

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SECTION 102113
PHENOLIC TOILET COMPARTMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Phenolic partitions ASI Accurate Partitions Alpaco Elegance.

1.02 RELATED SECTIONS

A. Section 061000 - Wood Framing: Concealed wood framing and blocking for compartment support.

B. Section 10800 - Toilet and Bath Accessories.

1.03 REFERENCES

A. ASTM International: ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

B. United States Green Building Council (USGBC): LEED Green Building Rating System.

1.04 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Literature indicating typical panel, pilaster, door, hardware and fastening.
   2. Preparation instructions and recommendations.
   3. Storage and handling requirements and recommendations.
   4. Installation methods.

C. Shop Drawings:
   1. Dimensioned plans indicating layout of toilet compartments.
   2. Dimensioned elevations indicating heights of doors, pilasters, separation partitions, and other components; indicate locations and sizes of openings in compartment separation partitions for toilet and bath accessories to be installed in partitions; indicate floor and ceiling clearances.
   3. Details indicating anchoring components (bolt layouts) and methods for project conditions; indicate components required for installation, but not supplied by toilet compartment manufacturer.

D. Selection Samples: For each finish product specified, one complete set of color selection guides representing manufacturer's full range of available colors, textures and patterns.

E. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, texture and pattern.

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

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and handle materials and products in strict compliance with manufacturer's instructions and recommendations and industry standards.

B. Store products indoors in manufacturer's or fabricator's original containers and packaging, with labels clearly identifying product name and manufacturer. Protect from damage.

C. Lay cartons flat, with adequate support to ensure flatness and to prevent damage to pre-finished surfaces.

D. Do not store where ambient temperature exceeds 120 degrees F (49 degrees C).

1.06 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

B. Do not deliver materials or begin installation until building is enclosed, with complete protection from outside weather, and building temperature maintained at a minimum of 60 degrees F (15.6 degrees C).

1.07 WARRANTY

A. Manufacturers Standard Warranty: Provide warranty for Phenolic Material against delamination, breakage, or corrosion for 10 years, assuming proper maintenance according to manufacturer's recommendations.

1.08 COORDINATION

A. Coordinate Work with placement of support framing and anchors in walls and ceilings.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer: ASI Accurate 160 Tower Drive, Burr Ridge, IL 60527 Tel: 442-6800; Fax: 708-442-7439; Web: www.asi-accuratepartitions.com
   1. Color Thru Phenolic
   2. ALPACO Classic Collection

B. Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.02 COMPARTMENTS AND SCREENS

A. Toilet Compartments: Floor anchored/overhead braced.
   1. Compartment Depth and Width: As scheduled and indicated on Drawings.
   2. Door Width: 24 inches (610 mm), minimum; at ADA accessible compartments 36 inches (915 mm) minimum.

B. Privacy and Urinal Screens: Wall hung.

2.03 SOLID PHENOLIC

A. (10.2113.01) Solid phenolic toilet partitions; floor mounted, overhead braced; panels 12" above floor; Accurate Partitions Company "Color Thru Phenolic"
   1. Doors and Pilasters - Shall be ¾” thick with solid phenolic core and decorative surface sheet on both faces.
   2. Panels and Urinal Screens - Shall be ½” thick with solid phenolic core and decorative surface sheet on both faces.
   3. Material - Doors, panels, pilasters and urinal screens shall be fabricated from phenolic material comprised of multiple layers of melamine resin impregnated kraft paper, and a decorative surface sheet on both faces. All layers shall be fused together under high temperature and pressure.
   4. Finish - All components shall be water-resistant. Rough edges shall be machine sanded with a 45 degree radius edge.
   5. Color - Shall be selected from Accurate’s full range of standard designer colors.
   6. Door Hardware - Shall be Accurate, gravity cam-action hinge that permits door to return to a pre-set position when not locked. Hinge, strike/keeper and slide latch shall be brushed finish to resist corrosion and thru-bolted with tamper resistant barrel nuts and shoulder screws. Cam-action hinge shall allow emergency access by lifting the door from the bottom.
   7. Mounting Hardware - Cast stainless steel stirrup brackets with brushed finish shall be secured to walls and pilasters with stainless steel tamper resistant fasteners. Panels shall be thru-bolted with tamper resistant barrel nuts and shoulder screws.
   8. Construction Design - Partitions shall be floor anchored with a 3/8” x 1” mounting bar attached to the bottom of the pilaster. Each mounting bar shall be anchored to the floor with 3/8” wedge anchors. The anchoring system shall be concealed by a type 304 stainless steel trim shoe with a #4 finish. Aluminum headrail with anti-grip profile shall provide overhead bracing and span all partitions and brace the end pilaster to the back wall.

PART 3 EXECUTION

3.01 EXAMINATION AND PREPARATION

A. Inspect and prepare substrates using the methods recommended by the manufacturer for achieving best result for the substrates under project conditions. Clean surfaces thoroughly prior to installation.

B. Do not proceed with installation until substrates have been prepared using the methods recommended by the manufacturer and deviations from manufacturer's recommended tolerances are corrected. Commencement of installation constitutes acceptance of conditions.

C. If preparation is the responsibility of another installer, notify Engineer in writing of deviations from manufacturer's recommended installation tolerances and conditions.
   1. Verify dimensions of areas to receive compartments.
   2. Verify locations of built-in framing, anchorage, bracing, and plumbing fixtures.

3.02 INSTALLATION

A. Install in accordance with approved shop drawings and manufacturer's instructions.

B. Fasten components to adjacent materials and to other components using purpose-designed fastening devices.

C. Adjust pilaster anchors for substrate variations.

D. Equip each compartment door with hinges and door latch.

E. Equip each compartment door with one coat hook and bumper.

F. Installation Tolerances:
   1. Maximum variations from plumb or level: 1/8 inch (3 mm).
   2. Clearance between wall surface and panels or pilasters: 1-1/2 inch (38 mm) maximum.

3.03 ADJUSTING

A. Adjust and align hardware to uniform clearance at vertical edge of doors.

B. Adjust adjacent components for consistency of line or plane.

3.04 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

C. Remove factory protective coverings and clean finish surfaces in accordance with manufacturer's instructions before substantial completion.

END OF SECTION

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SECTION 102800
TOILET ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Commercial toilet accessories.

B. Electric hand dryers.

C. Utility room accessories.

1.02 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.

B. ASTM C1036 - Standard Specification for Flat Glass 2021.

C. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror 2018.

D. ASTM F2285 - Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use 2004, with Editorial Revision (2016).

1.03 SUBMITTALS

A. See Division 1 for submittal procedures.

B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Commercial Toilet, Shower, and Bath Accessories:
   1. AJW Architectural Products: www.ajw.com.
   2. American Specialties, Inc: www.americanspecialties.com.
   3. Bradley Corporation: www.bradleycorp.com.
   4. Bobrick; www.bobrick.com.
   5. Substitutions: Section 016000 - Product Requirements.

B. Electric Hand Dryers:
   1. American Dryer, Inc: www.americandryer.com/#sle.
   2. Excel Dryer: www.exceldryer.com/#sle.
   3. Frost Products Limited: www.frostproductsltd.com.
   4. World Dryer Corporation: www.worlddryer.com.
   5. Substitutions: Section 016000 - Product Requirements.

2.02 MATERIALS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.

B. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.

2.03 FINISHES

A. Stainless Steel: Satin finish, unless otherwise noted.

2.04 COMMERCIAL TOILET ACCESSORIES

A. (10.2800.01) Toilet paper dispenser, double roll, recessed w/ satin finish, Bobrick #B667.

B. (10.2800.03) Automatic universal semi recess mounted roll towel dispenser; Bobrick #B-29744

C. (10.2800.05) Soap Dispenser: Liquid soap dispenser, wall-mounted, surface, with stainless steel cover and horizontal stainless steel tank and working parts; push type soap valve, check valve, and window gauge refill indicator, tumbler lock Bobrick #B211.

D. (10.2800.06) Mirrors: Stainless steel framed, 1/4 inch thick annealed float glass;ASTM C1036, 24" x 48"; Bobrick #B165 2448.

E. (10.2800.07) Seat Cover Dispenser: Stainless steel, surface-mounted, Bobrick #B221.

F. (10.2800.08) Heavy Duty Grab Bars: Floor supports are acceptable if necessary to achieve load rating, Bobrick 1-1/2", peened stainless steel.

G. 10.2800.09) Sanitary Napkin Disposal Unit: Stainless steel, back-to-back partition mounting, Bobrick #B4354.

H. (10.2800.10) Toiletry shelf, x 24" long, stainless steel, Bobrick #B683 x 24".

I. (10.2800.11) Electric hand dryer: Excel Dryer Inc; ThinAir Hand Dryer:
   1. www.exceldryer.com/#sle.

J. (10.2800.14) Mop and broom Holder, stainless steel, 4 spring loaded rubber cam holders x 36" long; Bobrick #B223 x 36.

K. (10.2800.60) Grab bar 12" x 1-1/2"; heavy duty; peened Bobrick B--6806.

L. (10.2800.61) Grab bar 18" x 1-1/2"; heavy duty; peened Bobrick B--6806.

M. (10.2800.62) Grab bar 30" x 1-1/2"; heavy duty; peened Bobrick B--6806.

N. (10.2800.63) Grab bar 36" x 1-1/2"; heavy duty; peened Bobrick B--6806.

O. (10.2800.64) Grab bar 42" x 1-1/2"; heavy duty; peened Bobrick B--6806.

P. (10.2800.65) Grab bar 48" x 1-1/2"; heavy duty; peened Bobrick B--6806.

2.05 UTILITY ROOM ACCESSORIES

A. Mop and Broom Holder: 0.05 inch (1.3 mm) thick stainless steel, Type 304, hat-shaped channel.
   1. Holders: Four spring-loaded rubber cam holders.
      a. Length: 36 inches (900 mm).
      b. Bobrick model #B-223 x 36

2.06 CLOSET SHELVING

A. Basis of Design: Knape & Vogt Mfg. Co., which is located at: 2700 Oak Industrial Dr. N.E.; Grand Rapids, MI 49505-6083; Toll Free Tel: 800-253-1561; Tel: 616-459-3311; Fax: 616-459-0249; Web: www.knapeandvogt.com | www.knapeandvogt.com

B. Or approved equal.

C. Heavy Duty Shelf Decorative Standards and Brackets:
   1. Shelf Standard Components: Heavy-Duty Decorative 82 Standard double-slotted channel wall standards. Standards mounted to a suitable wall surface with mounting hardware 16 inches (406 mm) o.c. is capable of supporting 300 to 450 pounds per pair of standards when properly installed.
      a. Face: 1-31/64 inch (37.7 mm) wide by 11/16 inch (17.5 mm) deep, double slotted.
      b. Material and Finish: Steel.
      c. Finish: White, powder-coat; provide screws with matching heads.
      d. Lengths: As required to support shelving indicated.
      e. Shelf Bracket Components: Steel, reinforced, locking into slots; size to suit shelves. Brackets adjustable in 1-1/4 inch (31.8 mm) increments along entire length of standard, drilled and countersunk for screws.
      f. Shelving: Wire shelving; 12" wide white finish

2.07 MISCELLANEOUS

A. Closet Rod: Stainless steel with end support flanges.

B. Substitutions: Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify exact location of accessories for installation.

3.02 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.

B. Install plumb and level, securely and rigidly anchored to substrate.

C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.

END OF SECTION

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SECTION 104400
FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire extinguishers.

B. Fire extinguisher cabinets.

C. Accessories.

1.02 REFERENCE STANDARDS

A. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems 2013a (Reapproved 2017).

B. NFPA 10 - Standard for Portable Fire Extinguishers 2017, with Errata (2018).

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide extinguisher operational features.

C. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

D. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

PART 2 PRODUCTS

2.01 FIRE PROTECTION SPECIALTY ELEMENTS

A. (10.4400.01) Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge; Type A,B,C; 2.5 lbs.

B. (10.4400.02) Fire Extinguisher Cabinets, Fire Rating: Listed and labeled in accordance with ASTM E814 requirements for fire resistance rating of walls where being installed.

C. (10.4400.03) Lettering: "FIRE EXTINGUISHER" in accordance with authorities having jurisdiction (AHJ).

2.02 MANUFACTURERS

A. Fire Extinguishers:
   1. Ansul, a Tyco Business: www.ansul.com/#sle.
   2. Kidde, a unit of United Technologies Corp: www.kidde.com/#sle.
   3. Nystrom, Inc: www.nystrom.com/#sle.
   4. Oval Brand Fire Products; Oval Dry Chemical Fire Extinguisher - Multipurpose ABC: www.ovalfireproducts.com/#sle.
   5. Pyro-Chem, a Tyco Business: www.pyrochem.com/#sle.
   6. Substitutions: See Section 016000 - Product Requirements.

B. Fire Extinguisher Cabinets and Accessories:
   1. Activar Construction Products Group - JL Industries: www.activarcpg.com/#sle.
   2. Kidde, a unit of United Technologies Corp: www.kidde.com/#sle.
   3. Larsen's Manufacturing Co: www.larsensmfg.com/#sle.
   4. Nystrom, Inc: www.nystrom.com/#sle.
   5. Oval Brand Fire Products: www.ovalfireproducts.com/#sle.
   6. Potter-Roemer: www.potterroemer.com/#sle.
   7. Substitutions: See Section 016000 - Product Requirements.

2.03 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.

B. (10.4400.01) Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge; Type A,B,C; 2.5 lbs.
   1. Class: A:B:C type.

2. Temperature range: Minus 40 degrees F (Minus 40 degrees C) to 120 degrees F (49 degrees C).

2.04 FIRE EXTINGUISHER CABINETS

A. (10.4400.02) Fire Extinguisher Cabinets, Fire Rating: Listed and labeled in accordance with ASTM E814 requirements for fire resistance rating of walls where being installed.

B. Fire Rated Cabinet Construction: One-hour fire rated.

C. Cabinet Configuration: Semi-recessed type.
   1. Size to accommodate accessories.

2.05 ACCESSORIES

A. Lettering: “FIRE EXTINGUISHER” decal, or vinyl self-adhering, pre-spaced black lettering in accordance with authorities having jurisdiction (AHJ).

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Secure rigidly in place.

C. Place extinguishers in cabinets.

END OF SECTION

SECTION 105100
LOCKERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Lockers of the following types:
   1. Heavy duty metal lockers, Traditional Plus Collection.
   2. Locker accessories.

1.02 REFERENCES

A. ADAAG - American with Disabilities Act, Accessibility Guidelines.

B. ANSI A117.1 - Accessible and Usable Buildings and Facilities.

C. ASTM International (ASTM):
   1. ASTM A 1008 - Standard Specification for Steel Sheet, Carbon, Cold-Rolled, Commercial Quality.
   2. ASTM D 4976 - Standard Specification for Polyethylene Plastics Molding and Extrusion Materials.
   3. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.03 SUBMITTALS

A. Submit under provisions of Section 01 30 00 - Administrative Requirements.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

C. Shop Drawings: Provide layout and elevations of lockers with overall dimensions.

D. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms.

E. Verification Samples: For finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product and color selected.

1.04 QUALITY ASSURANCE

A. Provide all lockers from a single manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Inspect lockers upon receipt for visible damage. Further inspection if necessary for hidden damage.

B. Store products in manufacturer's unopened packaging until ready for installation.

C. Sequence deliveries to avoid project delays, but minimize on-site storage.

PART 2 PRODUCTS

2.01 LOCKER ELEMENTS

A. (10.5100.11) Heavy duty metal lockers; single tier, 78" h x 18" w x 18" deep.
   1. ASI Storage Solutions Traditional Plus collection.

B. (10.5113.90) Hardwood locker bench, 72" L x 9-1/2" W

C. (10.5113.91) Bench pedestals, 2 per bench, heavy duty cast iron or steel standard height

2.02 MANUFACTURERS

A. Acceptable Manufacturer: ASI Storage Solutions, which is located at: 2171 Liberty Hill Rd.; Eastanollee, GA 30538; Tel: 706-827-2720; Fax: 706-827-2710; Email: request info (info@asi-storage.com); Web: asistorage.com

B. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

2.03 MATERIALS

A. Steel: Prime grade mild cold-rolled sheet steel free from surface imperfection, capable of taking a powder coating finish.
   1. Hooks: Zinc plated forged steel, ball ends.
   2. Bolts and Nuts: Zinc plated truss fin head bolts, hex nuts.
   3. Rivets.

2.04 HEAVY DUTY METAL LOCKERS

A. Heavy Duty Metal Lockers; ASI Storage Solutions Traditional Plus collection; single tier
   1. Acceptable Product: ASI Storage Solutions Traditional Plus Collection.
   2. Type of Lockers: Welded.
   3. Single Tier:
      a. Height: 78 inches (1981 mm).
      b. Size: 18 inches (457 mm) wide by 18 inches (457 mm) deep.
   4. Material: Steel parts shall be mild cold tolled commercial quality steel, ASTM A1008.
   5. Finish: Steel surfaces shall be power washed, phosphate treated and finished with an electrostatically applied 2 mm thick hybrid epoxy/polyester powder coating and baked.
   6. Construction: Lockers shall be built on a unitized principle with common intermediate uprights separating units.
   7. Door Frames: 16 gauge formed in a channel shape. Vertical members shall have additional flange to provide a continuous door strike. Cross frame members; 16 gauge channel shaped
   8. Doors: 14 gauge, channel shaped on both the lock and hinge side, with angle formations across the top and bottom. Locker doors shall have 16 gauge full height reinforcement channel in the door edges.
   9. Body:
      a. Bottoms: 16 gauge.
      b. Tops, Sides, Backs and Shelves, Knocked Down: 24 gauge.
      c. Tops, Sides, Backs and Shelves, Welded: 18 gauge.
      d. Bolt spacing shall not exceed 9 inches (228 mm) o.c.
   10. Hinges: Full length 16 gauge continuous piano type, riveted to both door and frame.
   11. Handles: One-piece 20 gauge deep drawn stainless steel cup designed to accommodate locks.
   12. Latching: An 11 gauge frame hook shall be secured to the fame. The frame shall have a padlock hasp protruding through the recessed handle. A rubber silencer shall be firmly secured to the frame at each latch hook.
   13. Interior Equipment:
      a. Single tier lockers 48 inches (1.219 m) or higher shall have a shelf.
      b. Single tier lockers 18 inches (457 mm) deep or more shall have a coat rod instead of a ceiling hook.
   14. Number Plates: Each locker shall have a polished aluminum number plate riveted to door face with black numerals 1/2 inch (12 mm) high.
   15. Finish: Doors and exposed body parts shall be finished in a baked on powder coat finish in color indicated.
      a. Color: White #29, Gray #25, Charcoal #23., Almond #03, Tan #01, Yellow # 50, Orange #05, Red #45, Burgundy #49, Plum #04, Sky Blue #31, Blue Frost #36, Mist Green #06, Pine Forest #53, or Black #11 .

2.05 LOCKER ACCESSORLES

A. Metal Locker Sloped Tops:
   1. Continuous slope top shall be 18 gauge sheet steel, powder coated to match the color of the lockers. Hoods are 72 inches (1.828 m) in length by depth of locker. For longer lengths, slip joints without visible fasteners at splice locations shall be provided. End closures shall be provided. The slope shall have a rise equal to 1/3 of the locker depth, plus a 1 inch (25 mm) vertical rise at the front.
   2. Individual sloped tops shall be 24 gauge sheet steel, powder coated to match the color of the lockers. Tops shall be formed to a slope which rises 1/3 of the locker depth.

B. Metal Locker Bases:

1. Base: Zee base shall be 14 gauge sheet steel, powder coated to match the color of the lockers.

C. Metal Locker Fillers-Vertical: Fillers shall be 20 gauge sheet steel, powder coated to match the color of the lockers.

D. Metal Locker Recess Trim: Recess trim shall be 18 gauge sheet steel, powder coated to match the color of the lockers.

E. Benches:
   1. Moveable Stainless Steel Bench: Pedestal shall be 2 inches (50 mm) in diameter, 16 gauge brushed stainless steel formed into the shape of a trapezoid. Bottom shall be 14 inches (356 mm) wide with tow (2) mounting holes. The pedestal shall be 16-1/4 inches (413 mm) high. The top flange shall have four (4) holes for fastening to the bench. Minimum spacing of bench support shall be 4 feet (1219 mm).
   2. Wood Bench Tops: Wood bench tops shall be fabricated of hardwood with all corners sanded and rounded and finished with two (2) coats of clear lacquer.
   3. Bench Top Width and Depth, ADA Compliant Units: 12 inches (305 mm) deep by 1-1/4 inches (32 mm) thick.
   4. Bench Top Length: As indicated on the Drawings.

F. Locks:
   1. Combination Padlocks: Rust resistant combination padlocks shall be furnished with and without master keying as required. Locks shall be 3-number dialing.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates and bases have been properly prepared.

B. If substrate and bases are the responsibility of another installer, notify Engineer of unsatisfactory preparation before proceeding.

3.02 INSTALLATION

A. Install lockers and accessories at locations shown in accordance with manufacturer's instructions.

B. Install lockers level and plumb with flush surfaces and rigid attachment to anchoring surfaces.

C. Anchor lockers to floor and wall at 48 inches (1.219 m) or less, as recommended by the manufacturer.

D. Fasten adjoining locker units together to provide rigid installation.

E. Install sloping tops and metal fillers using concealed fasteners. Provide flush hairline joints against adjacent surfaces.

F. Install front bases between legs without overlap or exposed fasteners. Provide end bases on exposed ends.

3.03 ADJUSTING AND CLEANING

A. Adjust doors and latches to operate without binding. Verify that latches are operating satisfactorily.

B. Touch-up factory-finish and repair or replace damaged products before Substantial Completion.

3.04 PROTECTION

A. Protect installed products until completion of project.

END OF SECTION

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SECTION 107020
ARCHITECTURAL CANOPIES

PART 1 GENERAL

1.01 SECTION INCLUDES:

A. Building supported, pre-engineered metal canopies including fascia channels, decking, tension rods, and attachment hardware.
   1. Related Sections:
      a. Division 01: Administrative, procedural, and temporary work requirements.

1.02 REFERENCES

A. Aluminum Association (AA)DAF 45 - Designation System for Aluminum Finishes.

B. American Architectural Manufacturers Association (AAMA)
   1. 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Architectural Extrusions and Panels.

C. American Society of Civil Engineers (ASCE) 7 - Minimum Design Loads for Buildings and Other Structures.

D. ASTM International (ASTM)
   1. B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
   2. B429 - Standard Specification for Aluminum-Alloy Extruded Pipe and Tube.

1.03 SYSTEM DESCRIPTION

A. Design Requirements: Design canopy system to withstand:
   1. Standards for wind pressure, snow load, and drifting snow load in accordance with current adopted form of the Uniform Construction code or accepted requirements of local municipality.

1.04 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Literature indicating typical panel, pilaster, door, hardware and fastening.
   2. Preparation instructions and recommendations.
   3. Storage and handling requirements and recommendations.
   4. Installation methods.

B. Submittals for Review:
   1. Shop Drawings: Indicate system components, dimensions, attachments, and accessories.
   2. Samples:
      a. 3 x 3 inch coating samples in specified color.
      b. 6 inch long fascia extrusion sample showing profile and finish.
      c. 6 inch decking samples showing profile and finish.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Minimum 5 years experience in installation of MASA products.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Contract Documents are based on: Extrudeck
   1. MASA Architectural Canopies 21 Randolph Ave.
   2. Avenel, NJ 07001
   3. 800-761-7446
   4. www.architecturalcanopies.com.
   5. Acceptable alternates:
      a. Substitutions: See Section 01 6000 - Product Requirements.

B. (10.7020.01) Architectural canopy, aluminum extrusions, internal gutter and drain; MASA Architectural Canopies Product: Extrudeck.

2.02 MATERIALS

A. Aluminum Extrusions:
   1. ASTM B221& ASTM B429 6061-T6 alloy and temper.

B. Hardware:
   1. All fasteners shall be stainless steel or hot dip galvanized for corrosion resistance.

2.03 COMPONENTS

A. Framing:
   1. Type: Extruded aluminum “J” channel fascia 2.
      a. Size: 8”x .125”
   2. Canopy Supports: 3” x 3” x .25 Extruded Aluminum Canopy Support “I” Beam

B. Decking: 3” x 6” x .078 Interlocking, Extruded Aluminum Flat soffit decking (as selected from MASA decking options)

C. Attachment: 1” diameter steel hanger rod finished to match canopy

D. Other Components: other components as indicated or as required for system attachment and performance.

2.04 ACCESSORIES

A. Anchors and Fasteners: Stainless steel or hot dip galvanized and corrosion resistant

2.05 FABRICATION

A. Fabricate canopy system in accordance with approved Shop Drawings.

B. All canopies to be mechanically assembled with a minimum shear stress strength of 350lbs. Pre- welding is not acceptable.

C. Drainage system to be concealed type. Covered surfaces direct water to field drilled drain, to be coordinated at site.

2.06 FINISHES

A. Aluminum:
   1. Pre- Treatment: Pre-treat to ASTM D1730 type B, Method 5 using a multi stage chromate process or an approved chrome- free pretreatment process approved by powder coating manufacturer for optimized weather resistance.
   2. Finish coat: AAMA 2603 Thermosetting Polyester Resin-based Powder
   3. Source: Tiger Drylac powder coating or equivalent.
   4. Color: Bronze to be selected by Engineer from MASA' s color range

PART 3 EXECUTION

3.01 FIELD DIMENSIONS

A. Field verify dimensions of supporting structure at site of installation prior to fabrication.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions and approved Shop Drawings.

B. Install components plumb and level, in proper plane, free from warp and twist.

C. Anchor system to building components; provide adequate clearance for movement caused by thermal expansion and contraction and wind loads.

3.03 ADJUSTING

A. Touch up minor scratches and abrasions on finished surfaces to match original finish.

END OF SECTION

SECTION 111365
LOADING DOCK EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Loading dock equipment of the following types:
   1. Dock seals.
   2. Vehicle (truck) restraints.
   3. Mechanical dock levelers.
   4. Dock safety package.
   5. Dock bumpers.

1.02 RELATED SECTIONS

A. Section 03 3000 - Cast-In-Place Concrete: Docks and pits -- see structural drawings.

B. Section 05 5000 - Metal Fabrications: Metal angles for edge of dock -- see structural drawings.

1.03 REFERENCES

A. American National Standards Institute (ANSI):
   1. ANSI MH29.1 - Industrial Scissor Lifts.
   2. ANSI MH30.1 - Industrial Loading Dock Boards (Ramps).
   3. ANSI MH30.3 - Vehicle Restraining Devices (Safety, Performance, and Testing).

1.04 SUBMITTALS

A. Section 01330 - Submittals Procedures: Procedures for submittals.

B. Product Data: For each product specified. Indicate unit dimensions, method of anchorage, and details of construction. Indicate materials and finish, installation details, roughing-in measurements, and operation of unit.

C. Shop Drawings:
   1. Indicate required opening dimensions, tolerances of opening dimensions, placement dimensions, and perimeter conditions of construction.
   2. Wiring diagrams including location of control stations and disconnect switches.

D. Assurance/Control Submittals:
   1. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
   2. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.

1.05 QUALITY ASSURANCE

A. Dock Levelers: Conform to requirements of ANSI MH30.1.

B. Vehicle Restraints: Conform to requirements of ANSI MH30.3.

C. Manufacturer Qualifications:
   1. Manufacturer specializing in manufacturing Products specified with minimum 30 years' experience.
   2. Manufacturer to have quality assurance improvement programs and ISO certified.
   3. Manufacturer shall be associated with Loading Dock Equipment Manufacturers (LODEM) setting ANSI standards.
   4. Manufacturers welding procedure compliant with A.W.S.D1.1 specifications.

D. Installer Qualifications: Company specializing in performing the Work of this Section with minimum 5 years' experience and in an authorized manufacturer's installer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and handle materials and products in strict compliance with manufacturer's instructions and recommendations and industry standards. Store materials within absolute limits for temperature and humidity recommended by manufacturer. Protect from damage.

B. Store products in manufacturer's labeled packaging until ready for installation.

1.07 WARRANTY

A. Warranty: Provide manufacturer's standard warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer: Blue Giant Equipment Corporation, which is located at: 410 Admiral Blvd.; Mississauga, ON, Canada L5T 2N6; Toll Free Tel: 800-872-2583; Tel: 905-457-3900; Fax: 905-457-2313; Email: marketing@bluegiant.com;
Web: https://www.bluegiant.com; other acceptable companies are RiteHite and Kelly.

B. Requests for substitutions will be considered in accordance with provisions of Section 01 6000.

2.02 DOCK SEALS

A. (11.1365.00) Dock Door Seal: Fixed Head Pad as manufactured by Blue Giant.
   1. Type: Fixed Head Pad Truck Dock Seal.
      a. Compression dock seals with foam-filled head and side pads.
      b. Cover Fabric Weight: 40 oz rubberized fabric.
      c. Color: Black / Safety Yellow.
      d. Unit projection 12 inches.
      e. Exposure on Vertical Flaps: 6 inches (152 mm). (standard)
   2. Finish and Color: Polyurethane foam core with 98 percent memory maintaining flexibility at -40 degrees C / -40 degrees F.
      a. The foam core shall be continuously bonded to the kiln dried lumber backing with a high quality adhesive.
      b. Head Pad shall be fixed type 119 inches wide x 12 inches high x 10 inches deep (3023 mm wide x 305 mm high x 250 mm deep) to suit a variety of trucks from 144 inches to 156 inches (3650 mm to 3960 mm) high.
      c. Side pads shall be 96 inches high x 12 inches wide x 10 inches deep (2438 mm high x 305 mm wide x 250 mm deep) with a 4 inches wide by 24 inches high (100 mm wide x 610 mm high) yellow guide stripe.
      d. Overlapping flaps shall be applied to side pads 11.5 inches x 10 inches (292 mm x 250 mm).
      e. All mounting hardware included shall be galvanized.
   3. Optional Features/Accessories: Provide the following optional features/accessories:
      a. Header flaps across entire head pad.
      b. Bottom flaps on verticals (each side).
      c. 48 inches (1219 mm) high skid guards on verticals (pair).
      d. Full height yellow guide stripe.
      e. Pressure-treated lumber.
      f. Fabric rain shroud.
      g. Fire retardant fabric.

2.03 VEHICLE (TRUCK) RESTRAINTS

A. **(11.1365.23) Vehicle Restraint: Model StrongArm HVR303 -Electric as manufactured by Blue Giant.**
   1. Type: Electrically operated impact-style design. Wall mounted. Comes complete with Blue Genius Touch Controls with interior/exterior communications light package and driver warning signs.
      a. Overall Body Dimensions: 18 inches W by 31-3/4 inches L by 27-7/8 inches H (457 mm by 806 mm by 708 mm).
   2. Function:
      a. Vertical Restraining Range: From 9 inches to 25 inches (229 mm to 635 mm) above grade, minimum 4 inches (102 mm) contact required.
      b. Restraint Type: Rotating yellow zinc dichromate steel hook.
      c. Mounting System: Dock face mounting using 15 anchor bolts 5/8-inch diameter by 4 inch long (16 mm by 102 mm).
   3. Operation:

a. Control Station For Dock Leveler - Vehicle Restraint Combination: Blue Genius Platinum Series Master Control Panel to control a combination of dock equipment including dock leveler, vehicle restraint, overhead doors, dock light seal. The Blue Genius Platinum Series Master Control Panel has a software-based operating sequence which can be customized to suit application requirements. Equipment is controlled via touch buttons that correspond to the equipment's function It has a NEMA4X/IP65 (wet and corrosion resistant) rated polycarbonate enclosure. Overall dimensions 20.59 inches L x 14 inches W x 5-1/2 inches D (523 x 356 x 140 mm). For added safety, the control station has a 'STOP' button that halts or limits the motion of connected dock equipment.
b. Lights Communication System: Interior red, yellow, and green indicator lights mounted on the control station. Exterior LED red and green high visibility traffic style lights and direct mirror image driver's warning signs. The lighting system alerts both dock attendant and truck driver to the status of the restraint. If vehicle has no restraining ICC bar, the control station light will flash yellow and the LCD message screen will advise dock attendant that the vehicle is not secured and wheel chocks are required.

4. Rated Capacity: Welding procedure compliant with ANSI AWS D1.1 (2008) specifications. Unit provides restraining strength of 32,000lbs (14,500 kg).
5. Construction and Finish:
   a. Vehicle restraint: Restraint arm is constructed of one 1-1/4 inch (32 mm) thick solid steel. The housing protects all components from damage from weather, dirt and debris. To resist corrosion and reduce maintenance, housing is zinc plated.
   b. Exterior LED Traffic Lights: Housing shall be one-piece, weatherproof constructed and made of ultra-high molecular weight plastic. The lights shall be 4 inch (102 mm) diameter of red and green color. Overall body 5 inches W x 11-1/2 inch L x 1/2 inch D (127 x 292 x 13 mm) in size.
6. Accessories: Provide the following standard accessories.
   a. Lip guide to prevent dock leveler lip from impacting the restraint
   b. 15 heavy-duty wedge anchor bolts
   c. Interlock control station with interlock sensor to advise when dock is parked.
   d. Stop button that permits the operator to cut power to the restraint should an unsafe condition arise.
7. Optional Features/Accessories: Provide the following optional features/accessories:
   a. Extension plates to suit extended dock leveler pit, edge of dock levelers, and bumper depths.
   b. 4 feet (1219 mm) manual release key to unlock the hook.
   c. Dock / pit support reinforcement bracket for dock face below 26 inches (660 mm).
   d. Bracket for brick / block dock face with added support for concrete ground mount.
   e. Enhanced security feature: Enable or disable the restraint via supervisory code.

2.04 MECHANICAL DOCK LEVELERS

A. Mechanical Dock Levelers: 'A' Series Dock Levelers, Model 'MA' as manufactured by BLUE GIANT.
   1. Type: Recessed, pit installed hinged dock leveler. Manually operated dock leveler shall be mechanical and complete with cable locking hold down mechanism and 4 inches (102 mm) assured motion float (maintained deck tilt). Pit Depth: Front 20 inches (508 mm) and Rear 19-1/2 inches (495 mm). Deck length includes 16 inches (406 mm) lip.
   2. See structural drawings for concrete recess and steel angle. Contractor to coordinate with the dock leveler manufacturer and finalize all dimensions.
      a. (11.1365.056) Model MA7008: Deck Size - 83 inches (2108 mm) W by 99-1/2 inches (2527 mm) L.
   3. Function:
      a. Vertical Travel: Working range of 12 inches (305 mm) above and 12 inches (305 mm) below dock level.
      b. Automatic Vertical Compensation: Unit provides float of 12 inches (305 mm) above and 12 inches (305 mm) below dock level.

c. Automatic Lateral Compensation: Provides maintained side-to-side deck tilt of up to 4 inches (102 mm) to compensate for canted truck beds.
d. Lip Operation: Mechanically operated lip that automatically extends and locks into position. Lip will yield under impact of incoming truck and will automatically drop pendant upon truck's departure. The length of the lip extension shall not be less than 16 inches (406 mm) from the ramp edge.

4. Operation:
   a. Mechanical Operating System: No manual lifting involved. Attendant pulls release chain that activates the locking hold down system designed to minimize cross traffic bounce and provide instant hold. The deck is driven up by heavy-duty lift springs and the lip is smoothly powered out. Dock is then "walked" down onto the truck bed. A second chain is pulled to disengage the fall safe legs and allow below level operation. When the truck departs, the lip releases, allowing the unit to be returned to the cross-traffic position.
5. Rated Capacity:
   a. Welding procedure compliant with A.W.S.D1.1 specifications. All units rated in compliance with ANSI MH30.1. Structural deck support to include minimum six each high-tensile solid steel I-beam members.
   b. Capacity: 65,000 lb.
6. Standard Safety Devices:
   a. Mechanical fall safe legs to limit free fall and below level lip control for end-loading.
   b. Toe Guard: Working range metal toe guard protection.
   c. Cross traffic support - lip engaged in saddles.
   d. Corner safety stops.
   e. Telescopic v-grooved maintenance strut, integral to unit.
   f. Beveled lip.
7. Finish and Color:
   a. Toe guards painted safety yellow as specified by ANSI Z535.1. High visibility OSHA safety striping on stationary side toe guards.
   b. Remainder of unit primed with 2 factory applied coats of rust-inhibiting primer base under colored finish coating.
   c. Remainder of unit painted blue, standard.
8. Standard Accessories:
   a. Night Locks.
   b. 16 inch (406mm) long lip.
9. Dock Bumpers: Standard, two model DB411 laminated bumpers 14 inches (356 mm) W by 10 inches (254 mm) H by 4.5 inches (114 mm) D.
10. Lip Extensions: 18 inches (457 mm) long lip.
11. Optional Features/Accessories: Provide the following optional features/accessories:
    a. Foam insulation underside of deck.
    b. Side weather seals, rubber style.
    c. Rear weather seals, rubber style.
    d. Clean pit frame.
    e. Mechanical fall safe legs to limit free fall and below level lip control for end-loading.
    f. Automatic Light Communication Package (model TLC24-A): Lights are automatically operated via a 24VDC proximity switch or photo-eye sensor. Can be set to manual operation. Includes LED interior bulbs and LED exterior traffic lights.

2.05 CONTROL STATIONS

A. (11.1365.300) Blue Genius Platinum Series Master Control Panel: As manufactured by BLUE GIANT.
   1. Type: Multiple touch button control station.
   2. Standard Features:
      a. NEMA4X / IP65 polycarbonate enclosure- resistant to both corrosion and wet conditions.

b. Printed circuit board technology.
c. Keypad with supervisory override option.
d. Network connections- bidirectional communication and power wiring.
e. Onboard diagnostics and self-testing.
f. LCD intelligent display.
g. Red/Green/Yellow LED interior Lights Communication System.
h. Integral rotary disconnect (nonfused)
i. Duplex receptacle / step-down transformer: 4 amp
j. Finger safeguard against risk of shock.
k. UL/CSA approved.

3. Function: The Blue Genius Platinum Series Master Control Panel controls a combination of dock equipment: dock leveler, vehicle restraint, overhead doors, dock light seal. Software-based operating sequence can be customized to suit application requirements. The LED Lights Communication System (Red, Yellow, and Green) is mounted on the controller and supplemented by driver warning signs. Safety devices include door interlock terminals (24VDC provided) and a 'STOP' touch button that will limit or halt equipment motion.
4. Operating System: Loading dock equipment connected to the Blue Genius Platinum Series Master Control Panel Control Panel is controlled via touch buttons that correspond to the equipment's function. The 'STOP' button that halts or limits the motion of connected dock equipment.
5. Lights Communication System: The lights communication system consists of LED red/yellow/green lights mounted on the control station and a set of exterior red/green traffic lights mounted on exterior wall, on the driver's side of the dock entrance. This system alerts both dock attendant and truck driver to current safety conditions.
6. Power: 115/230 V, 60 Hz, Single Phase.
7. Construction and Finish: The Blue Genius is a multiple touch button control station NEMA4X/IP65 (wet and corrosion resistant) rated polycarbonate enclosure. Overall dimensions 20.59 inches L x 14 inches W x 5-1/2 inch D (523 x 356 x 140 mm).
8. Exterior LED Traffic Lights: The housing shall be one-piece, weatherproof constructed and made of ultra high molecular weight plastic. The lights shall be 4 inches (102 mm) diameter of red and green color. Overall body 5 inches W x 11-1/2 inches L x 1/2 inch D (127 x 292 x 13 mm) in size.

2.06 DOCK BUMPERS

A. Dock Bumpers: Two per dock leveler as manufactured by Blue Giant.
1. Type: Laminated and shall be made of nylon impregnated heavy-duty industrial rubber and punched to receive 5/8 inch (16 mm) supporting rod. Bumper material shall be assembled with two 3 inches by 3 inches by 1/4 inch (76 by 76 by 6 mm) thick steel angles, factory painted and fastened with threaded rod and nut. Dimensions include angle iron for laminated bumpers.
a. (11.1365.405) Model DB511: 5-1/2 inches D by 14 inches W by 10 inches H (140 mm D by 356 mm W by 254 mm H).

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not proceed with installation until substrates have been properly prepared and deviations from manufacturer's recommended tolerances are corrected. Commencement of installation constitutes acceptance of conditions.

B. Prepare substrates using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. If preparation is the responsibility of another installer, notify Engineer in writing of deviations from manufacturer's recommended installation tolerances and conditions.

D. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work. Correct and deficencies as needed.

3.02 INSTALLATION

A. Install products in prepared opening in accordance with manufacturer's instructions. Set square and level. Anchor unit securely, flush with dock. Weld back of dock leveler to pit frame. Touch-up welds with matching paint.

B. Install all loading dock equipment in strict accordance with manufacturer's instructions.

3.03 ADJUSTING

A. Adjust installed unit for smooth and balanced operation.

B. Demonstrate functionality, subject to Engineer's approval.

END OF SECTION

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SECTION 123200
MANUFACTURED WOOD CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Manufactured standard and custom casework, with cabinet hardware.

1.02 RELATED REQUIREMENTS

A. Section 123600 - Countertops: Additional requirements for countertops.

1.03 DEFINITIONS

A. Exposed: Portions of casework visible when drawers and cabinet doors are closed, including end panels, bottoms of cases more than 42 inches (1.066 m) above finished floor, tops of cases less than 72 inches (1.82 m) above finished floor and all members visible in open cases or behind glass doors.

B. Semi-Exposed: Portions of casework and surfaces behind solid doors, tops of cases more than 72 inches (1.828 m) above finished floor and bottoms of cabinets more than 30 inches (0.762 m) but less than 42 inches (1.066 m) above finished floor.

C. Concealed: Sleepers, web frames, dust panels and other surfaces not generally visible after installation and cabinets less than 30 inches (762 mm) above finished floor.

1.04 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition 2014, with Errata (2016).

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Component dimensions, configurations, construction details, joint details, attachments.

C. Shop Drawings: Indicate casework types, sizes, and locations, using large scale plans, elevations, and cross sections. Include rough-in and anchors and reinforcements, placement dimensions and tolerances, clearances required, and keying information.

D. Samples for Finish Selection: Fully finished, for color selection. Minimum sample size: 2 inches by 3 inches (51 mm by 75 mm).
   1. Plastic laminate samples, for color, texture, and finish selection.

E. Manufacturer's Installation Instructions.

F. Maintenance Data: Manufacturer's recommendations for care and cleaning.

G. Finish touch-up kit for each type and color of materials provided.

1.06 QUALITY ASSURANCE

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

B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience and approved by manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect items provided by this section, including finished surfaces and hardware items during handling and installation. For metal surfaces, use polyethylene film or other protective material standard with the manufacturer.

B. Acceptance at Site:
   1. Do not deliver or install casework until the conditions specified under Part 3, Examination Article of this section have been met. Products delivered to sites that are not enclosed and/or improperly conditioned will not be accepted if warping or damage due to unsatisfactory conditions occurs.

C. Storage:

1. Store casework in the area of installation. If necessary, prior to installation, temporarily store in another area, meeting the environmental requirements specified under Part 3, "Site Verification of Conditions" Article of this section.

1.08 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion, at no additional cost to Owner. Defects include, but are not limited to:
   1. Ruptured, cracked, or stained finish coating.
   2. Discoloration or lack of finish integrity.
   3. Cracking or peeling of finish.
   4. Failure of hardware.

PART 2 PRODUCTS

2.01 MANUFACTURED CASEWORK ELEMENTS

A. (12.3200.81) Drawer and Door Pulls: Wire pulls, satin nickel; 4" x 5/16" diameter.

B. (12.3200.82) Catches: Friction type, BHMA A156.9, B03033.

C. (12.3200.83) Drawer Slides: "Knape & Vogt" Heavy Duty, 3/4 extension epoxy coated drawer slide

D. 12.3200.84) Hinges: Concealed (fully mortised) self-closing type, BHMA No. A156.9, B01602, Equal to "Blum" compact 33 hinge series designed to open 120 degrees..

E. (12.3200 85) 1/4" Nickel "L" shaped shelf support
   1. Four (4) supports per shelf, BHMA A156.9, B04071.
   2. Shelf rests, BHMA A156.9, B04081.

F. (12.3200.86) Sliding Glass Panels: "EPCO" #38A514 extruded aluminum lower track and #48A14 upper guide for 1/4" sliding glass.

G. (12.3200.87) 2" grommet for cable passage through countertop
   1. Grommets for Cable Passage through countertops: 1 inch OD brown, molded plastic grommets with brown plastic cap.

H. (12.3200.88) Cabinet Door locks: BHMA A156.11, E0712, E07041

I. (12.3200.89) Cabinet Drawer locks: BHMA A156.11, E07041

J. (12.3200.100) Plastic laminate breakroom casework.

K. (12.3200.102) Plastic laminate kitchenette casework.

L. (12.3200.104) Plastic laminate casework.

M. (12.3200.105) Plastic laminate casework; base cabinet.

N. (12.3200.106) Plastic laminate casework; 22" deep base cabinet.

O. (12.3200.107) Plastic laminate casework; 24" deep base cabinet.

P. (12.3200.108) Plastic laminate casework; 12" deep tall cabinet.

Q. (12.3200.109) Plastic laminate casework; 16" deep tall cabinet.

R. (12.3200.110) Plastic laminate casework; 24" deep tall cabinet.

S. (12.3200.111) Plastic laminate casework; 12" deep wall cabinet.

T. (12.3200.112) Plastic laminate casework; 16" deep wall cabinet.

U. (12.3200.113) Plastic laminate casework; 24" deep wall cabinet.

V. (12.3200.114) Plastic laminate casework; end panel.

W. (12.3200.115) Plastic laminate casework; filler piece.

X. (12.3200.116) Plastic laminate casework; molding.

2.02 CASEWORK, GENERAL

A. Quality Standard: AWI/AWMAC/WI (AWS), unless noted otherwise.

B. Plastic Laminate Faced Cabinets: Custom Grade.

2.03 FABRICATION

A. Assembly: Shop assemble casework items for delivery to site in units easily handled and to permit passage through building openings.

B. Construction: As required for selected grade.

C. Structural Performance: Safely support the following minimum loads:
   1. Base Units: 500 pounds per linear foot (744 kgs/linear m) across the cabinet ends.
   2. Suspended Units: 300 pounds (136 kg) static load.
   3. Drawers: 125 pounds (57 kg), minimum.
   4. Hanging Wall Cases: 300 pounds (135 kg).
   5. Shelves: 100 pounds (45 kg), minimum.

D. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.

E. Scribes and Fillers: Panels of matching construction and finish, for locations where cabinets do not fit tight to adjacent construction.

2.04 PLASTIC-LAMINATE-CLAD CASEWORK

A. Plastic-Laminate-Clad Casework: Solid wood and wood panel construction; each unit self-contained and not dependent on adjacent units or building structure for rigidity; in sizes necessary to avoid field cutting except for scribes and filler panels. Include adjustable levelers for base cabinets.
   1. Style: Flush overlay. Ease doors and drawer fronts slightly at edges.
   2. Cabinet Nominal Dimensions: Unless otherwise indicated, provide cabinets of widths and heights indicated on drawings, and with following front-to-back dimensions:
      a. Base Cabinets: 22 inches (559 mm).
      b. Tall Cabinets: 22 inches (559 mm).
      c. Wall Cabinets: 16 inches (406 mm).
   3. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline.
      a. Finish: Matte or suede, gloss rating of 5 to 20.
      b. Surface Color and Pattern: As selected by Engineer from manufacturer's full line.
      c. Exposed Interior Surfaces: Thermally fused laminate.
         1) Color: White.
      d. Cap exposed plastic laminate finish edges with material of same finish and pattern.

2.05 COUNTERTOPS

A. Countertops: As specified in Section 123600.

2.06 ACCESSORIES

A. (12.3200.81) Drawer and Door Pulls: Wire pulls, satin nickel; 4" x 5/16" diameter.

B. (12.3200.82) Catches: Friction type, BHMA A156.9, B03033.

C. (12.3200.83) Drawer Slides: "Knape & Vogt" Heavy Duty, 3/4 extension epoxy coated drawer slide

D. 12.3200.84) Hinges: Concealed (fully mortised) self-closing type, BHMA No. A156.9, B01602, Equal to "Blum" compact 33 hinge series designed to open 120 degrees..

E. (12.3200 85) 1/4" Nickel "L" shaped shelf support
   1. Four (4) supports per shelf, BHMA A156.9, B04071.
   2. Shelf rests, BHMA A156.9, B04081.

F. (12.3200.86) Sliding Glass Panels: "EPCO" #38A514 extruded aluminum lower track and #48A14 upper guide for 1/4" sliding glass.

G. (12.3200.87) 2" grommet for cable passage through countertop
   1. Grommets for Cable Passage through countertops: 1 inch OD brown, molded plastic grommets with brown plastic cap.

H. (12.3200.88) Cabinet Door locks: BHMA A156.11, E0712, E07041

I. (12.3200.89) Cabinet Drawer locks: BHMA A156.11, E07041

J. Heavy duty shelf brackets:
   1. Centerline Counter top bracket: 14"; 18", 24" 30"
      a. Front Mount Plus mounting bracket
      b. Manufacturer: Centerline Steel, LLC | 125 Douglas Park Drive, Ste. 5, St. Augustine, FL 32084
         1) Phone: 888-960-3854; Fax: 904-429-9450; Email: support@countertopbracket.com
   2. (12.3200.90) Bracket for 1' 6" wide counter
      a. 14" x 10" x 2" custom bracket; finish: black painted, mounting: front, recessed mount
   3. (12.3200.91) Bracket for 2' 0" wide counter
      a. 18" x 10" x 2" custom bracket; finish: black painted, mounting: front, recessed mount
   4. (12.3200.92) Bracket for 2' 6" wide counter
      a. 24" x 10" x 2" custom bracket; finish: black painted, mounting: front, recessed mount
   5. (12.3200.93) Bracket for 3' 0" wide counter
      a. 30" x 22" x 2" custom bracket; finish: black painted, mounting: front, recessed mount
   6. Place brackets 6" from either end of counter top and 24" on center, see plan for details and blocking requirements

PART 3 EXECUTION

3.01 EXAMINATION

A. Site Verification of Environmental Conditions:
   1. Do not deliver casework until the following conditions have been met:
      a. Building has been enclosed (windows and doors sealed and weather-tight).
      b. An operational HVAC system that maintains temperature and humidity at occupancy levels has been put in place.
      c. Ceiling, overhead ductwork, piping, and lighting have been installed.
      d. Installation areas do not require further “wet work” construction.

B. Verify adequacy of support framing and anchors.

C. Verify that service connections are correctly located and of proper characteristics.

3.02 INSTALLATION

A. Perform installation in accordance with manufacturer's instructions.

B. Use anchoring devices to suit conditions and substrate materials encountered. Use concealed fasteners to the greatest degree possible. Use exposed fasteners only where allowed by approved shop drawings, or where concealed fasteners are impracticable.

C. Set casework items plumb and square, securely anchored to building structure.

D. Align cabinets to adjoining components, install filler and/or scribe panels where necessary to close gaps.

E. Fasten together cabinets in continuous runs, with joints flush, uniform and tight. Misalignment of adjacent units not to exceed 1/16 inch (1.6 mm). In addition, do not exceed the following tolerances:
   1. Variation of Tops of Base Cabinets from Level: 1/16 inch (1.6 mm) in 10 feet (3 m).
   2. Variation of Faces of Cabinets from a True Plane: 1/8 inch (3 mm) in 10 feet (3 m).
   3. Variation of Adjacent Surfaces from a True Plane (Lippage): 1/32 inch (0.8 mm).
   4. Variation in Alignment of Adjacent Door and Drawer Edges: 1/16 inch (1.6 mm).

F. Base Cabinets: Fasten cabinets to service space framing and/or wall substrates, with fasteners spaced not more than 16 inches (407 mm) on center. Bolt adjacent cabinets together with joints flush, tight, and uniform.

G. Install hardware uniformly and precisely.

H. Countertops: Install countertops intended and furnished for field installation in one true plane, with ends abutting at hairline joints, and no raised edges.

I. Replace units that are damaged, including those that have damaged finishes.

3.03 CLEANING

A. Clean casework and other installed surfaces thoroughly.

3.04 PROTECTION

A. Do not permit finished casework to be exposed to continued construction activity.

B. Protect casework and countertops from ongoing construction activities. Prevent workmen from standing on or storing tools and materials on casework or countertops.

C. Repair damage, including to finishes, that occurs prior to Date of Substantial Completion, using methods prescribed by manufacturer; replace units that cannot be repaired to like-new condition.

END OF SECTION

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SECTION 123600
COUNTERTOPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Countertops for manufactured casework.

1.02 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.

B. ISFA 3-01 - Classification and Standards for Quartz Surfacing Material 2013.

C. NEMA LD 3 - High-Pressure Decorative Laminates 2005.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Specimen warranty.

C. Shop Drawings: Complete details of materials and installation; combine with shop drawings of cabinets and casework specified in other sections.

D. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.

E. Test Reports: Chemical resistance testing, showing compliance with specified requirements.

F. Certificate: Submit labels and certificates required by quality assurance and quality control programs.

1.04 QUALITY ASSURANCE

A. Quality Certification:
   1. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
   2. Provide designated labels on shop drawings as required by certification program.
   3. Provide designated labels on installed products as required by certification program.
   4. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

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

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.06 FIELD CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.01 COUNTERTOP ELEMENTS

A. (12.3600.00) Quartz resin countertops: 1- 1/4" thick

B. (12.3600.00) Quartz resin windowsills: Cambria Newport Marble Collection, 3/4" thick.

2.02 COUNTERTOPS

A. Natural Quartz and Resin Composite Countertops: Sheet or slab of natural quartz and plastic resin over continuous substrate.
   1. Flat Sheet Thickness: 1-1/4 inch (32 mm), minimum.

2. Natural Quartz and Resin Composite Sheets, Slabs and Castings: Complying with ISFA 3-01 and NEMA LD 3; orthophthalic polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
    a. Manufacturers:
        1) Caesarstone; www.casaerstoneusa.com.
        2) Cambria; www.cambriausa.com.
        3) Substitutions: See Section 016000 - Product Requirements.
    b. Factory fabricate components to the greatest extent practical in sizes and shapes indicated; comply with the MIA Dimension Stone Design Manual.
    c. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
    d. Finish on Exposed Surfaces: Polished.
    e. Color and Pattern: As selected by Engineer from manufacturer's full line.
3. Exposed Edge Treatment: Built up to minimum 1-1/4 inch (32 mm) thick; square edge; use marine edge at sinks.
4. Back and End Splashes: Same sheet material, square top; minimum 4 inches (102 mm) high.

B. Window sills
1. Flat Sheet Thickness: 3/4 inch (19 mm), minimum.
2. Natural Quartz and Resin Composite Sheets, Slabs and Castings: Complying with ISFA 3-01 and NEMA LD 3; orthophthalic polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
3. Manufacturers:
    a. Terrazzo & Marble Supply Companies; DIFINITI Quartz
        : www.tmsupply.com/#sle.
    b. Substitutions: See Section 016000 - Product Requirements.
4. Factory fabricate components to the greatest extent practical in sizes and shapes indicated; comply with the MIA Dimension Stone Design Manual.
5. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
6. NSF approved for food contact.
    a. Finish on Exposed Surfaces: Polished.
7. Color and Pattern: As selected by Engineer from manufacturer's full line.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Engineer of unsatisfactory preparation before proceeding.

C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.02 INSTALLATION

A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.

B. Seal joint between back/end splashes and vertical surfaces.

3.03 TOLERANCES

A. Variation From Horizontal: 1/8 inch in 10 feet (3 mm in 3 m), maximum.

B. Offset From Wall, Countertops: 1/8 inch (3 mm) maximum; 1/16 inch (1.5 mm) minimum.

C. Field Joints: 1/8 inch (3 mm) wide, maximum.

END OF SECTION

SECTION 133419
METAL BUILDING SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Primary and secondary structural-steel framing, metal roof panels, metal wall panels, thermal insulation, accessories and miscellaneous components required for a complete building.

B. Manufacturer-engineered, shop-fabricated structural steel building frame.

C. Insulated Metal wall and roof panels including soffits, gutters and downspouts, and roof mounted equipment curbs.

D. Exterior doors, windows, skylights, overhead doors, and louvers.

1.02 RELATED REQUIREMENTS

A. Section 072312 - Pre-Engineered Building Insulation

B. Section 079200 - Joint Sealants: Sealing joints between accessory components and wall system.

C. Section 081113 - Hollow Metal Doors and Frames.

D. Section 083613 - Sectional Doors.

1.03 REFERENCE STANDARDS

A. AISC 360 - Specification for Structural Steel Buildings 2016.

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

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.

D. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process 2021.

E. ASTM C827/C827M - Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures 2016.

F. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink) 2017.

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021.

H. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials 2016.

I. ASTM E966 - Standard Guide for Field Measurement of Airborne Sound Attenuation of Building Facades and Facade Elements 2018a.

J. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength 2020.

K. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength 2019, with Editorial Revision (2020).

L. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination 2012.

M. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020.

N. IAS AC472 - Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems 2018.

O. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic") 2002 (Ed. 2004).

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: For each type of metal building system component indicated.

C. Shop Drawings: 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. Anchor-Bolt Plans: Submit anchor-bolt plans before foundation work begins. **Submittal is required within one week after award of contract.** Include location, diameter, and projection of anchor bolts required to attach metal building to foundation. Indicate column reactions at each location.
   3. Structural-Framing Drawings: Show complete fabrication of primary and secondary framing; include provisions for openings. Indicate welds and bolted connections, distinguishing between shop and field applications. Include transverse cross-sections.
   4. Metal Roof and Wall Panel Layout Drawings: Show layouts of metal panels including methods of support. Include details of edge conditions, joints, panel profiles, corners, anchorages, trim, flashings, closures, and special details. Distinguish between factory- and field-assembled work; show locations of exposed fasteners.

D. Samples: For each type of building component and for each color and texture required.

E. Letter of Design Certification: Signed and sealed by a qualified professional engineer. Include the following:
   1. Name and location of Project.
   2. Order number.
   3. Name of manufacturer.
   4. Name of Contractor.
   5. Building dimensions including width, length, height, and roof slope.
   6. Indicate compliance with AISC standards for hot-rolled steel and AISI standards for cold-rolled steel, including edition dates of each standard.
   7. Governing building code and year of edition.
   8. Design loads and load combinations.
   9. Building-use category.
   10. AISC Certification for Category MB: Include statement that metal building system and components were designed and produced in an AISC-Certified Facility by an AISC-Certified Manufacturer.

F. Welding certificates.

G. Erector Certificate: Signed by manufacturer certifying that erector complies with requirements.

H. Material Test Reports: For each of the following products:
   1. Structural steel including chemical and physical properties.
   2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
   3. Tension-control, high-strength, bolt-nut-washer assemblies.
   4. Shop primers.
   5. Nonshrink grout.

I. Manufacturer certificate.

J. Surveys: Show final elevations and locations of major members. Have surveyor who performed surveys certify their accuracy.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: Design structural components, develop shop drawings, and perform shop and site work under direct supervision of a Professional Structural Engineer experienced in design of this type of work.
   1. Design Engineer Qualifications: Licensed in the State in which the Project is located.
   2. Comply with applicable code for submission of design calculations as required for acquiring permits.

3. Cooperate with regulatory agency or authorities having jurisdiction (AHJ), and provide data as requested.
4. Perform work in accordance with AISC 360, MBMA (MBSM), and IBC 2018.

B. Manufacturer Qualifications: Company specializing in the manufacture of products similar to those required for this project.
1. AISC Certification for Category MB: An AISC-Certified Manufacturer that designs and produces metal building systems and components in an AISC-Certified Facility.
2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

C. Erector Qualifications: An experienced erector who has specialized in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer. Company specializing in performing the work of this section with minimum 10 years experience.

D. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

E. Structural Steel: Comply with AISC's "Specification for Structural Steel Buildings--Allowable Stress Design, Plastic Design," or AISC's "Load and Resistance Factor Design Specification for Structural Steel Buildings," for design requirements and allowable stresses.

F. Cold-Formed Steel: Comply with AISI's "Specification for the Design of Cold-Formed Steel Structural Members," or AISI's "Load and Resistance Factor Design Specification for Steel Structural Members," for design requirements and allowable stresses.

G. Pre-Erection Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to metal building systems including, but not limited to, the following:
1. Inspect and discuss condition of foundations and other preparatory work performed by other trades.
2. Review structural load limitations.
3. Review required testing, inspecting, and certifying procedures.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, sheets, panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness and with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

1.07 PROJECT CONDITIONS

A. Established Dimensions for Foundations: Comply with established dimensions on approved anchor-bolt plans, establishing foundation dimensions and proceeding with fabricating structural framing without field measurements. Coordinate anchor-bolt installation to ensure that actual anchorage dimensions correspond to established dimensions.

1.08 COORDINATION

A. Coordinate size and location of concrete foundations and casting of anchor-bolt inserts into foundation walls and footings. Concrete, reinforcement, and formwork requirements are specified in Division 03 Section "Cast-in-Place Concrete."

B. Coordinate installation of equipment supports and roof penetrations, which are specified in Division 07 Section "Roof Accessories."

1.09 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Special Warranty on Metal Panel Finishes: Manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
      b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Buildings Systems:
   1. Butler Manufacturing Company: www.butlermfg.com.
   2. Ceco Building Systems: www.cecobuildings.com.
   3. Chief Buildings: www.chiefbuildings.com.
   4. Metallic Building Company: www.metallic.com.
   5. Nucor Building Systems: www.nucorbuildingsystems.com.
   6. VP Buildings: www.vp.com.
   7. Substitutions: See Section 016000 - Product Requirements.

2.02 ASSEMBLIES

A. Single span rigid frame.

B. Primary Framing: Rigid frame of rafter beams and columns, canopy beams, and wind bracing.

C. Secondary Framing: Purlins, and other items detailed.

D. Wall System: Preformed metal panels of vertical profile, with sub-girt framing/anchorage assembly, and accessory components.

E. Roof System: Preformed metal panels oriented parallel to slope, with sub-girt framing/anchorage assembly, insulation, and liner system with thermal blocks, and accessory components.

F. Roof Slope: 0.5 inches in 12 inches.

2.03 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design Metal building system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Provide metal building systems capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
   1. Engineer metal building systems according to procedures in MBMA's "Metal Building Systems Manual."
   2. Design Loads: As indicated on Drawings.

C. Seismic Performance: Design and engineer metal building systems capable of withstanding the effects of earthquake motions determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."

D. Deflection Limits: Design metal building system assemblies to withstand design loads with deflections no greater than the following:
   1. Purlins and Rafters: Vertical deflection of 1/180 of the span for total load, 1/240 of the span for live load.
   2. Girts: Horizontal deflection of 1/180 of the span.
   3. Metal Roof Panels: Vertical deflection of 1/180 of the span.
   4. Metal Wall Panels: Horizontal deflection of 1/180 of the span.
   5. Design secondary-framing system to accommodate deflection of primary framing and construction tolerances and maintain clearances at openings.

E. Drift Limits: Engineer building structure to withstand design loads with lateral drift limits no greater a maximum of 1/200 of the building height.

F. Thermal Movements: Provide metal panel systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Design Temperature Change (Range): 63°C (120°F) ambient and 95°C (180°F) for material surfaces.

G. Thermal Performance: Provide insulated metal panel assemblies with the following maximum U-factors and minimum R-values for opaque elements when tested according to ASTM C 1363 or ASTM C 518:

   1. Installed Thermal Resistance of Wall System: R-value of 13.
   2. Installed Thermal Resistance of Roof System: R-value of 21.

H. Water Penetration for Metal Roof Panels: No water penetration when tested according to ASTM E 1646 at test-pressure difference of 2.86 lbf/sq. ft.

I. Water Penetration for Metal Wall Panels: No water penetration when tested according to ASTM E 331 at a wind-load design pressure of not less than 2.86 lbf/sq. ft.

J. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL Class 90 rating for wind uplift classification.

2.04 STRUCTURAL-FRAMING MATERIALS

A. W-Shapes: ASTM A 992/A 992M.

B. Channels, Angles, M-Shapes, and S-Shapes: ASTM A 36/A 36M; ASTM A 572/A 572M, Grade 50 or 55; or ASTM A 529/A 529M, Grade 50 or 55.

C. Plate and Bar: ASTM A 36/A 36M; ASTM A 572/A 572M, Grade 50 or 55; or ASTM A 529/A 529M, Grade 50 or 55.

D. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.

E. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B or C, structural tubing.

F. Structural-Steel Sheet: Hot-rolled, ASTM A 1011/A 1011M, Structural Steel (SS), Grades 30 through 55, or High-Strength Low Alloy Steel (HSLAS), Grades 45 through 70; or cold-rolled, ASTM A 1008/A 1008M, Structural Steel (SS), Grades 25 through 80, or High-Strength Low Alloy Steel (HSLAS), Grades 45 through 70.

G. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grades 33 through 80 or High-Strength Low Alloy Steel (HSLAS), Grades 50 through 80; with G60 coating designation; mill phosphatized.

H. Metallic-Coated Steel Sheet Prepainted with Coil Coating: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
   1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grades 33 through 80 or High-Strength Low Alloy Steel (HSLAS), Grades 50 through 80; with G90 coating designation.
   2. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Structural Steel (SS), Grade 50 or 80; with Class AZ50 coating.

I. Non-High-Strength Bolts, Nuts, and Washers: ASTM A 307, Grade A, carbon-steel, hex-head bolts; ASTM A 563 carbon-steel hex nuts; and ASTM F 844 plain (flat) steel washers.
   1. Finish: Plain.

J. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.
   1. Finish: Plain.

K. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy-hex-head steel structural bolts with splined ends.
   1. Finish: Plain.

L. High-Strength Bolts, Nuts, and Washers: ASTM A 490, Type 1, heavy hex steel structural bolts or tension-control, bolt-nut-washer assemblies with splined ends; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers, plain.

M. Unheaded Anchor Rods: ASTM F 1554, Grade 36.
   1. Configuration: Straight.
   2. Nuts: ASTM A 563 heavy hex carbon steel.
   3. Plate Washers: ASTM A 36/A 36M carbon steel.
   4. Washers: ASTM F 436 hardened carbon steel.
   5. Finish: Plain.

N. Headed Anchor Rods: ASTM F 1554, Grade 36 straight.
   1. Nuts: ASTM A 563 heavy hex carbon steel.
   2. Plate Washers: ASTM A 36/A 36M carbon steel.
   3. Washers: ASTM F 436 hardened carbon steel.
   4. Finish: Plain.

O. Threaded Rods: ASTM A 36.
   1. Nuts: ASTM A 563 heavy hex carbon steel.
   2. Washers: ASTM F 436 hardened carbon steel.
   3. Finish: Plain.

P. Primer: SSPC-Paint 15, Type I, red oxide.

2.05 MATERIALS FOR FIELD-ASSEMBLED METAL PANELS

A. Metallic-Coated Steel Sheet Prepainted with Coil Coating: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
   1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grades 33 through 80, with G90 coating designation.
   2. Surface: Smooth, flat finish.
   3. Exposed Finishes: As indicated on Drawings:
   4. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored backer finish, consisting of prime coat and wash coat with a total minimum dry film thickness of 0.5 mil (0.013 mm).

2.06 DOOR AND FRAME MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B, suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with G60 (Z180) zinc (galvanized) or A60 (ZF180) zinc-iron-alloy (galvannealed) coating designation.

2.07 MISCELLANEOUS MATERIALS

A. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide fasteners with heads matching color of materials being fastened by means of plastic caps or factory-applied coating.

1. Fasteners for Metal Roof Panels: Self-drilling or self-tapping, zinc-plated, hex-head carbon-steel screws, with a stainless-steel cap or zinc-aluminum-alloy head and EPDM or neoprene sealing washer.
2. Fasteners for Metal Wall Panels: Self-drilling Type 410 stainless-steel or self-tapping Type 304 stainless-steel or zinc-alloy-steel hex washer head, with EPDM or PVC washer under heads of fasteners bearing on weather side of metal panels.

B. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

C. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

D. Metal Panel Sealants:
1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing.
2. Joint Sealant: ASTM C 920; one-part elastomeric polyurethane, polysulfide, or silicone-rubber sealant.

2.08 FABRICATION, GENERAL

A. Tolerances: Comply with MBMA's "Metal Building Systems Manual": Chapter IV, Section 9, "Fabrication and Erection Tolerances."

B. Metal Panels: Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of metal panel.

2.09 STRUCTURAL FRAMING

A. General:
1. Primary Framing: Shop fabricate framing components to indicated size and section with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.
   a. Make shop connections by welding or by using high-strength bolts.
   b. Join flanges to webs of built-up members by a continuous submerged arc-welding process.
   c. Brace compression flange of primary framing with steel angles or cold-formed structural tubing between frame web and purlin or girt web, so flange compressive strength is within allowable limits for any combination of loadings.
   d. Shop Priming: Prepare surfaces for shop priming according to SSPC-SP 2. Shop prime primary structural members with specified primer after fabrication.
2. Secondary Framing: Shop fabricate framing components to indicated size and section by roll-forming or break-forming, with baseplates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.
   a. Shop Priming: Prepare uncoated surfaces for shop priming according to SSPC-SP 2. Shop prime uncoated secondary structural members with specified primer after fabrication.

B. Primary Framing: Manufacturer's standard structural primary framing system, designed to withstand required loads and specified requirements. Primary framing includes transverse and lean-to frames; rafter, rake, and canopy beams; sidewall, intermediate, end-wall, and corner columns; and wind bracing. Provide frames with attachment plates, bearing plates, and splice members. Factory drill for field-bolted assembly. Provide frame span and spacing indicated.
1. Rigid Clear-Span Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Interior columns are not permitted.
2. Frame Configuration: Lean to, with high side connected to, and supported by, another structure.
3. Exterior Column Type: Tapered.
4. Rafter Type: Tapered.

C. End-Wall Framing: Manufacturer's standard primary end-wall framing fabricated for field-bolted assembly to comply with the following:

1. End-Wall and Corner Columns: I-shaped sections fabricated from structural-steel shapes; shop-welded, built-up steel plates; or C-shaped, cold-formed, structural-steel sheet; with minimum thickness of 0.0598 inch.
2. End-Wall Rafters: C-shaped, cold-formed, structural-steel sheet; with minimum thickness of 0.0598 inch; or I-shaped sections fabricated from shop-welded, built-up steel plates or structural-steel shapes.

D. Secondary Framing: Manufacturer's standard secondary framing members, including purlins, girts, eave struts, flange bracing, base members, gable angles, clips, headers, jambs, and other miscellaneous structural members. Fabricate framing from cold-formed, structural-steel sheet or roll-formed, metallic-coated steel sheet prepainted with coil coating, unless otherwise indicated, to comply with the following:
1. Purlins: C- or Z-shaped sections; fabricated from minimum 0.0598-inch- (1.5-mm-) thick steel sheet, built-up steel plates, or structural-steel shapes; minimum 2-1/2-inch- (64-mm-) wide flanges.
   a. Depth: As required to comply with system performance requirements.
2. Girts: C- or Z-shaped sections; fabricated from minimum 0.0598-inch- (1.5-mm-) thick steel sheet, built-up steel plates, or structural-steel shapes. Form ends of Z-sections with stiffening lips angled 40 to 50 degrees to flange and with minimum 2-1/2-inch- (64-mm-) wide flanges.
   a. Depth: As required to comply with system performance requirements.
3. Eave Struts: Unequal-flange, C-shaped sections; fabricated from 0.0598-inch- (1.5-mm-) thick steel sheet, built-up steel plates, or structural-steel shapes; to provide adequate backup for metal panels.
4. Flange Bracing: Minimum 2-by-2-by-1/8-inch (51-by-51-by-3-mm) structural-steel angles or 1-inch (25-mm) diameter, cold-formed structural tubing to stiffen primary frame flanges.
5. Sag Bracing: Minimum 1-by-1-by-1/8-inch (25-by-25-by-3-mm) structural-steel angles.
6. Base or Sill Angles: Minimum 3-by-2-by-0.0598-inch (76-by-51-by-1.5-mm) zinc-coated (galvanized) steel sheet.
7. Purlin and Girt Clips: Minimum 0.0598-inch- (1.5-mm-) thick, steel sheet. Provide galvanized clips where clips are connected to galvanized framing members.
8. Secondary End-Wall Framing: Manufacturer's standard sections fabricated from minimum 0.0598-inch- (1.5-mm-) thick, zinc-coated (galvanized) steel sheet.
9. Framing for Openings: Channel shapes; fabricated from minimum 0.0598-inch- (1.5-mm-) thick, cold-formed, structural-steel sheet or structural-steel shapes. Frame head and jamb of door openings, and head, jamb, and sill of other openings.
10. Miscellaneous Structural Members: Manufacturer's standard sections fabricated from cold-formed, structural-steel sheet; built-up steel plates; or zinc-coated (galvanized) steel sheet; designed to withstand required loads.

E. Bracing: Provide adjustable wind bracing as follows:
1. Rods: ASTM A 36/A 36M; ASTM A 572/A 572M, Grade 50 (345); or ASTM A 529/A 529M, Grade 50 (345); minimum 1/2-inch- (13-mm-) diameter steel; threaded full length or threaded a minimum of 6 inches (152 mm) at each end.
2. Cable: ASTM A 475, 1/4-inch- (6-mm-) diameter, extra-high-strength grade, Class B zinc-coated, 7-strand steel; with threaded end anchors.
3. Angles: Fabricated from structural-steel shapes to match primary framing, of size required to withstand design loads.
4. Rigid Portal Frames: Fabricate from shop-welded, built-up steel plates or structural-steel shapes to match primary framing; of size required to withstand design loads.
5. Fixed-Base Columns: Fabricate from shop-welded, built-up steel plates or structural-steel shapes to match primary framing; of size required to withstand design loads.
6. Diaphragm Action of Metal Panels: Design metal building to resist wind forces through diaphragm action of metal panels.
7. Bracing: Provide wind bracing using any method specified above, at manufacturer's option.

F. Bolts: Provide plain finish bolts for structural-framing components that are primed or finish painted. Provide zinc-plated or hot-dipped galvanized bolts for structural-framing components that are galvanized.

G. Factory-Primed Finish: Apply specified primer immediately after cleaning and pretreating.
   1. Prime primary, secondary, and end-wall structural-framing members to a minimum dry film thickness of 1 mil (0.025 mm).
      a. Prime secondary steel framing formed from uncoated steel sheet to a minimum dry film thickness of 0.5 mil (0.013 mm) on each side.
   2. Prime galvanized members with specified primer, after phosphoric acid pretreatment.

2.10 METAL ROOF PANELS

A. Trapezoidal-Rib, Standing-Seam Metal Roof Panels: Formed with raised trapezoidal ribs at panel edges and intermediate stiffening ribs symmetrically spaced between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels.
   1. Material: Zinc-coated (galvanized) steel sheet, 0.0269 inch (0.70 mm) thick.
      a. Exterior Finish: As indicated on drawings.
      b. Color: As selected by Architect from manufacturer's full range.
   2. Clips: Manufacturer's standard, floating type to accommodate thermal movement; fabricated from zinc-coated (galvanized) steel sheet.
   3. Retain subparagraph above or first subparagraph below.
   4. Joint Type: Mechanically seamed.

2.11 FIELD-ASSEMBLED METAL WALL PANELS

A. Tapered-Rib-Profile, Exposed-Fastener Metal Wall Panels: Formed with raised, trapezoidal major ribs and intermediate stiffening ribs symmetrically spaced between major ribs; designed to be field assembled by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps.
   1. Material: Zinc-coated (galvanized) steel sheet, 0.0269 inch (0.70 mm) thick.
      a. Exterior Finish: As indicated on drawings.
      b. Color: As selected by Architect from manufacturer's full range.
   2. Major-Rib Spacing: 12 inches (305 mm) o.c.
   3. Panel Coverage: 36 inches (914 mm).
   4. Panel Height 1.5 inches (38 mm).

2.12 METAL SOFFIT PANELS

A. General: Provide factory-formed metal soffit panels designed to be field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners and factory-applied sealant in side laps. Include accessories required for weathertight installation.

B. Metal Soffit Panels: Match profile and material of metal wall panels.
   1. Finish: Match finish and color of metal wall panels.

2.13 ACCESSORIES

A. General: Provide accessories as standard with metal building system manufacturer and as specified. Fabricate and finish accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and with dimensional and structural requirements.

B. Roof Panel Accessories: Provide components required for a complete metal roof panel assembly including copings, fasciae, corner units, ridge closures, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels, unless otherwise indicated.
   1. Closures: Provide closures at eaves and ridges, fabricated of same material as metal roof panels.
   2. Retain first two subparagraphs below only with standing-seam metal roof panels.
   3. Clips: Manufacturer's standard, formed from steel sheet], designed to withstand negative-load requirements.
   4. Cleats: Manufacturer's standard, mechanically seamed cleats formed from stainless-steel sheet or nylon-coated aluminum sheet.
   5. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.

6. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal roof panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including copings, fasciae, mullions, sills, corner units, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels, unless otherwise indicated.
   1. Closures: Provide closures at eaves and rakes, fabricated of same material as metal wall panels.
   2. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

D. Flashing and Trim: Formed from minimum 0.0159-inch- (0.40-mm-) thick, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match adjacent metal panels.
   1. Opening Trim: Minimum 0.0269-inch- (0.70-mm-) thick, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Trim head and jamb of door openings, and head, jamb, and sill of other openings.

E. Gutters: Formed from minimum 0.0159-inch- (0.40-mm-) thick, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match roof fascia and rake trim. Match profile of gable trim, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch- (2438-mm-) long sections, sized according to SMACNA's "Architectural Sheet Metal Manual."
   1. Gutter Supports: Fabricated from same material and finish as gutters; spaced 36 inches (900 mm) o.c.

F. Downspouts: Formed from 0.0159-inch- (0.4-mm-) thick, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match metal wall panels. Fabricate in minimum 10-foot- (3-m-) long sections, complete with formed elbows and offsets.
   1. Mounting Straps: Fabricated from same material and finish as gutters; spaced 10 feet (3 m) o.c.

G. Roof Curbs: Fabricated from minimum 0.0428-inch- (1.1-mm-) thick, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match metal roof panels; with welded top box and bottom skirt, and integral full-length cricket; capable of withstanding indicated loads and of size and height indicated.
   1. Insulation: 1-inch- (25-mm-) thick, rigid type.

H. Pipe Flashing: Premolded, EPDM pipe collar with flexible aluminum ring bonded to base.

2.14 SOURCE QUALITY CONTROL

A. Special Inspector: Owner will engage a qualified special inspector to perform the following tests and inspections and to submit reports. Special Inspector will verify that manufacturer maintains detailed fabrication and quality-control procedures and will review the completeness and adequacy of those procedures to perform the Work.
   1. Special inspections will not be required if fabrication is performed by a manufacturer registered and approved by authorities having jurisdiction to perform such Work without special inspection.
      a. After fabrication, submit certificate of compliance with copy to authorities having jurisdiction certifying that Work was performed according to Contract requirements.

B. Tests and Inspections:
   1. Bolted Connections: Shop-bolted connections shall be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
   2. Welded Connections: In addition to visual inspection, shop-welded connections shall be tested and inspected according to AWS D1.1.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with erector present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Before erection proceeds, survey elevations and locations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments to receive structural framing, with erector present, for compliance with requirements and metal building system manufacturer's tolerances.
   1. Engage land surveyor to perform surveying.

C. Proceed with erection only after unsatisfactory conditions have been corrected.

3.02 ERECTION

A. Before erection proceeds, engage land surveyor to survey elevations and locations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments to receive structural framing, with Erector present, for compliance with requirements and metal building system manufacturer's tolerances.

B. Provide temporary shores, guys, braces, and other supports during erection to keep structural framing secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural framing, connections, and bracing are in place, unless otherwise indicated.

C. Erect metal building system according to manufacturer's written erection instructions and erection drawings.

D. Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional engineer.

E. Set structural framing accurately in locations and to elevations indicated and according to AISC specifications referenced in this Section. Maintain structural stability of frame during erection.

F. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
   1. Set plates for structural members on wedges, shims, or setting nuts as required.
   2. Tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
   3. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

G. Align and adjust structural framing before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with framing. Perform necessary adjustments to compensate for discrepancies in elevations and alignment. Level and plumb individual members of structure.

H. Primary Framing and End Walls: Erect framing true to line, level, plumb, rigid, and secure. Level baseplates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use grout to obtain uniform bearing and to maintain a level base-line elevation. Moist cure grout for not less than seven days after placement.
   1. Make field connections using high-strength bolts installed according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and snug-tightened or pretensioned joints.

I. Secondary Framing: Erect framing true to line, level, plumb, rigid, and secure. Fasten secondary framing to primary framing using clips with field connections using non-high-strength bolts.
   1. Provide rake or gable purlins with tight-fitting closure channels and fasciae.
   2. Locate and space wall girts to suit openings such as doors and windows.
   3. Provide supplemental framing at entire perimeter of openings, including doors, windows, louvers, ventilators, and other penetrations of roof and walls.

J. Bracing: Install bracing in roof and sidewalls where indicated on erection drawings.
   1. Tighten rod and cable bracing to avoid sag.
   2. Locate interior end-bay bracing only where indicated.

K. Framing for Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to structural framing.

L. Erection Tolerances: Maintain erection tolerances of structural framing within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

3.03 METAL PANEL INSTALLATION, GENERAL

A. General: Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
   1. Field cut metal panels as required for doors, windows, and other openings. Cut openings as small as possible, neatly to size required, and without damage to adjacent metal panel finishes. Field cutting of metal panels by torch is not permitted unless approved in writing by manufacturer.
   2. Install metal panels perpendicular to structural supports, unless otherwise indicated.
   3. Flash and seal metal panels with weather closures at perimeter of openings and similar elements. Fasten with self-tapping screws.
   4. Locate metal panel splices over, but not attached to, structural supports with end laps in alignment. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
   5. Lap metal flashing over metal panels to allow moisture to run over and off the material.

B. Lap-Seam Metal Panels: Install screw fasteners with power tools having controlled torque adjusted to compress neoprene washer tightly without damage to washer, screw threads, or metal panels. Install screws in predrilled holes. Arrange and nest side-lap joints so prevailing winds blow over, not into, lapped joints. Lap ribbed or fluted sheets one full rib corrugation.

C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.

D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal panel manufacturer.

3.04 METAL ROOF PANEL INSTALLATION

A. General: Provide metal roof panels of full length from eave to ridge, unless otherwise indicated or restricted by shipping limitations. Install ridge caps as metal roof panel work proceeds.

B. Field-Assembled, Lap-Seam Metal Roof Panels: Fasten metal roof panels to supports with exposed fasteners at each lapped joint at location and spacing recommended by manufacturer.
   1. Provide sealant tape at lapped joints of metal roof panels and between panels and protruding equipment, vents, and accessories.
   2. Apply a continuous ribbon of sealant tape to weather-side surface of fastenings on end laps and on side laps of nesting-type metal panels; on side laps of ribbed or fluted metal panels; and elsewhere as needed to make metal panels weatherproof to driving rains.
   3. At metal panel splices, nest panels with minimum 6-inch (152-mm) end lap, sealed with butyl-rubber sealant and fastened together by interlocking clamping plates.

C. Metal Fascia Panels: Align bottom of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Flash and seal metal panels with weather closures where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.

3.05 METAL WALL PANEL INSTALLATION

A. General: Install metal wall panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts, extending full height of building, unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.
   1. When two rows of metal panels are required, lap panels 4 inches (102 mm) minimum.
   2. When building height requires two rows of metal panels at gable ends, align lap of gable panels over metal wall panels at eave height.
   3. Rigidly fasten base end of metal wall panels and allow eave end free movement due to thermal expansion and contraction. Predrill panels.
   4. Flash and seal metal wall panels with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws.
   5. Install screw fasteners in predrilled holes.
   6. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated, or if not indicated, as necessary for waterproofing.
   7. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-tapping screws.
   8. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.

B. Field-Assembled, Metal Wall Panels: Install metal wall panels on exterior side of girts. Attach metal wall panels to supports with fasteners as recommended by manufacturer.

3.06 METAL SOFFIT PANEL INSTALLATION

A. Provide metal soffit panels full width of soffits. Install panels perpendicular to support framing.

B. Flash and seal metal soffit panels with weather closures where panels meet walls and at perimeter of all openings.

3.07 THERMAL INSULATION INSTALLATION FOR FIELD-ASSEMBLED METAL PANELS

A. General: Install insulation concurrently with metal wall panel installation, in thickness indicated to cover entire wall, according to manufacturer's written instructions.
   1. Set vapor-retarder-faced units with vapor retarder to warm side of construction, unless otherwise indicated. Do not obstruct ventilation spaces, except for firestopping.
   2. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to surrounding construction to ensure airtight installation.
   3. Install factory-laminated, vapor-retarder-faced blankets straight and true in one-piece lengths with both sets of facing tabs sealed to provide a complete vapor retarder.

B. Blanket Roof Insulation: Comply with the following installation method:
   1. Over-Framing Installation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing members. Hold in place by metal roof panels fastened to secondary framing.
   2. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.

C. Blanket Wall Insulation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing members. Hold in place by metal wall panels fastened to secondary framing.
   1. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.

3.08 DOOR AND FRAME INSTALLATION

A. General: Seal perimeter of each door frame with elastomeric sealant used for metal wall panels.

B. Personnel Doors and Frames: Install doors and frames according to ANSI A250.8. Shim as necessary to comply with DHI A115.IG. Fit non-fire-rated doors accurately in their respective frames.
   1. At fire-rated openings, install frames according to, and doors with clearances specified in, NFPA 80.

C. Field Glazing: Comply with installation requirements in Division 08 Section "Glazing."

3.09 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
   1. Install components required for a complete metal roof panel assembly including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
   2. Install components for a complete metal wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
   1. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (600 mm) of corner or intersection.

C. Gutters: Join sections with riveted and soldered or lapped and sealed joints. Attach gutters to eave with gutter hangers spaced not more than 4 feet (1.2 m) o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

D. Downspouts: Join sections with 1-1/2-inch (38-mm) telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch (25 mm) away from walls; locate fasteners at top and bottom and at approximately 60 inches (1500 mm) o.c. in between.
   1. Provide elbows at base of downspouts to direct water away from building.
   2. Tie downspouts to underground drainage system indicated.

E. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to panel as recommended by manufacturer.

F. Doors: After completing installation, test and adjust doors to operate easily, free of warp, twist, or distortion.

G. Windows: Adjust operating sashes and ventilators, screens, hardware, and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.

3.10 FIELD QUALITY CONTROL

A. Special Inspector: Owner will engage a qualified special inspector to perform the following tests and inspections and to submit reports.

B. Tests and Inspections:
   1. High-Strength, Field-Bolted Connections: Connections shall be tested and inspected during installation according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
   2. Welded Connections: In addition to visual inspection, field-welded connections shall be tested and inspected according to AWS D1.1.

3.11 CLEANING AND PROTECTION

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

C. Touchup Painting: After erection, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted structural framing[, bearing plates,] and accessories.
   1. Clean and prepare surfaces by SSPC-SP 2, "Hand Tool Cleaning," or SSPC-SP 3, "Power Tool Cleaning."
   2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

END OF SECTION

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SECTION 134200
INTEGRATED METAL FRAMED WALL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Light Gauge and Cold Formed Metal framed wall assemblies, rated and non-rated..

1.02 ABBREVIATIONS AND ACRONYMS

A. U.L.: Underwriter Laboratories.

B. STC: Sound Transmission Class.

C. ASTC: Assumed Sound Transmission Class.

D. LGM: Light Gauge Metal.

E. LGMF: Light Gauge Metal Framing.

F. CFM: Cold Formed metal.

G. CFMF: Cold Formed metal Framing.

H. GWB: Gypsum Wall Board

PART 2 PRODUCTS -- NOT APPLICABLE

PART 3 EXECUTION

3.01 LIGHT GAUGE METAL FRAMED WALL SYSTEMS

A. 13.4200.202: Wall Type 202
   1. Wall Type 202, LGMF wall, 3-5/8" LGM stud, 5/8" regular GWB one side, non insulated
      a. (09.2216.15) 'U' shaped track / runner
      b. (09.2216.15) 'U' shaped track / runner
      c. (09.2216.04) 3-5/8" LG metal stud
      d. (09.2216.18) Lateral bracing, pre-notched spacer bar
      e. (09.2116.53) 5/8" regular GWB

B. (13.4200.203) Wall Type 203
   1. Wall Type 203, LGMF wall, 3-5/8" LGM stud, 5/8" MR GWB one side, non insulated
      a. (09.2216.15) 'U' shaped track / runner
      b. (09.2216.15) 'U' shaped track / runner
      c. (09.2216.04) 3-5/8" LG metal stud
      d. (09.2216.18) Lateral bracing, pre-notched spacer bar
      e. (09.2116.60) 5/8" MR Type X GWB
      f. U.L. Rating: None

C. (13.4200.204) Wall Type 204
   1. Wall Type 204, LGMF wall, 3 5/8" LGM stud, 5/8" regular GWB both sides, Insulated
         1) (09.2116.53) 5/8" regular GWB
         2) (09.2216.15) 'U' shaped track / runner
            (a) Extend 1'-0" above adjacent ceilings.
         3) (09.2216.15) 'U' shaped track / runner
         4) (09.2216.04) 3-5/8" LG metal stud
         5) (09.2216.18) Lateral bracing, pre-notched spacer bar
         6) (07.2110.05) 3" Mineral wool insulation
         7) (09.2116.53) 5/8" regular GWB
         8) U.L. Rating: None

D. (13.4200.206) Wall Type 206
   1. Wall Type 206, Interior LGMF wall, 3-5/8" LGM stud, 5/8" MR GWB both sides, Insulated
      a. (09.2116.69) 5/8" MR GWB.
      b. (09.2216.15) 'U' shaped track / runner
         1) Extend 1'-0" above adjacent ceilings.
      c. (09.2216.15) 'U' shaped track / runner

d. (09.2216.04) 3-5/8" LG metal stud
e. (09.2216.18) Lateral bracing, pre-notched spacer bar
f. (07.2110.05) 3" Mineral wool insulation
g. (09.2116.69) 5/8" MR GWB.
h. U.L. Rating: None

E. (13.4200.209) Wall Type 209
1. Wall Type 209, Interior LGMF wall, 6" LGM stud, 5/8" regular GWB both sides, insulated
a. (09.2116.54) 5/8" regular GWB
b. (09.2216.15) 'U' shaped track / runner
c. (09.2216.15) 'U' shaped track / runner
d. (09.2216.07) 6" LG metal stud
e. (09.2216.18) Lateral bracing, pre-notched spacer bar
f. (07.2110.10) 6" Mineral wool insulation
g. (09.2116.54) 5/8" regular GWB
h. U.L. Rating: None

F. (13.4200.210) Wall Type 210
1. Wall Type 210, Interior LGMF wall, 6" LGM stud, 5/8" regular GWB one side, 5/8" MR GWB one side, insulated
a. (09.2116.54) 5/8" regular GWB
b. (09.2216.15) 'U' shaped track / runner
1) Extend 1'-0" above adjacent ceilings.
c. (09.2216.15) 'U' shaped track / runner
d. (09.2216.07) 6" LG metal stud
e. (09.2216.18) Lateral bracing, pre-notched spacer bar
f. (07.2110.10) 6" Mineral wool insulation
g. (09.2116.60) 5/8" MR Type X GWB
h. U.L. Rating: None

G. (13.4200.211) Wall Type 211
1. Wall Type 211, Interior LGMF wall, 6" LGM stud, 5/8" MR GWB both sides, insulated
a. (09.2116.60) 5/8" MR Type X GWB
b. (09.2216.15) 'U' shaped track / runner
1) Extend 1'-0" above adjacent ceilings.
c. (09.2216.15) 'U' shaped track / runner
d. (09.2216.07) 6" LG metal stud
e. (09.2216.18) Lateral bracing, pre-notched spacer bar
f. (07.2110.10) 6" Mineral wool insulation
g. (09.2116.60) 5/8" MR Type X GWB
h. U.L. Rating: None

H. 13.4200.220: Wall Type 220

I. (13.4200.221) Wall Type 221
1. Wall Type 221, Double LGMF chase wall, 3 5/8" LGM stud (two walls), 10-3/4" chase, 5/8" MR GWB both sides, non-insulated
a. (09.2116.60) 5/8"MR Type X GWB
b. (09.2216.15) 'U' shaped track / runner
1) Extend 1'-0" above adjacent ceilings.
c. (09.2216.15) 'U' shaped track / runner
d. (09.2216.04) 3-5/8" LG metal stud
e. (09.2216.18) Lateral bracing, pre-notched spacer bar
f. 10-3/4" chase
g. (09.2216.15) 'U' shaped track / runner
1) Extend 1'-0" above adjacent ceilings.
h. (09.2216.15) 'U' shaped track / runner
i. (09.2216.04) 3-5/8" LG metal stud
j. (09.2216.18) Lateral bracing, pre-notched spacer bar

k. (09.2116.60) 5/8"MR Type X GWB
l. U.L. Rating: None

J. (13.4200.225) Wall Type 225
1. Wall Type 225, Interior LGMF wall, 3-5/8" LGM stud, 5/8" regular GWB one side, 5/8" MR GWB one side, 3" mineral fiber insulation, non-rated
a. (09.2116.54) 5/8" regular GWB
b. (09.2216.15) 'U' shaped track / runner
1) Extend 1'-0" above adjacent ceilings.
c. (09.2216.16) 2-1/2" deep leg deflection track
d. (09.2216.15) 'U' shaped track / runner
e. (09.2216.04) 3-5/8" LG metal stud
f. (09.2216.18) Lateral bracing, pre-notched spacer bar
g. (07.2110.05) 3" Mineral wool insulation
h. (09.2116.60) 5/8" MR Type X GWB
i. U.L. Rating: None

3.02 STEEL STUD SHAFT WALL SYSTEMS

A. (13.4200.266) Wall type 266
1. Wall Type 266, Shaft wall, 3-1/8" wide; 2-1/2" CH studs @ 24" o.c., 1 layer 5/8" type 'X' GWB one side, 1" shaft liner, 2 hour fire-rated.
2. Wall type:
3. (09.2116.55) 5/8" type X GWB.
4. (09.2116.28) 2-1/2" Shaftwall CH stud.
5. (09.2116.58) 1" Type X SLX shaftliner GWB
6. Wall width: 3-1/8".
7. U.L. Rating: U415.

3.03 STEEL STUD SHAFT WALL SYSTEMS

A. (13.4200.411) Wall type 411
1. Wall Type 411, Shaft wall, 3-1/8" wide; 2-1/2" CH studs @ 24" o.c., 1 layer 5/8" type 'X' GWB one side, 1" shaft liner, 2 hour fire-rated.
2. Wall type:
3. (09.2116.55) 5/8" type X GWB.
4. (09.2116.28) 2-1/2" Shaftwall CH stud.
5. (09.2116.58) 1" Type X SLX shaftliner GWB
6. Wall width: 3-1/8".
7. U.L. Rating: U415.

END OF SECTION

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SECTION 134300
INTEGRATED MASONRY / CIP CONCRETE / PRECAST CONCRETE WALL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Masonry wall assemblies, rated and non-rated..

1.02 ABBREVIATIONS AND ACRONYMS

A. U.L.: Underwriter Laboratories.

B. STC: Sound Transmission Class.

C. ASTC: Assumed Sound Transmission Class.

PART 2 PRODUCTS -- NOT APPLICABLE

PART 3 EXECUTION - SCHEDULES

3.01 INTEGRATED MASONRY WALL SYSTEMS - NON-RATED

A. (13.4300.305) Wall Type 305
   1. (Old Type 54)
   2. Wall type 305, Basic 8" CMU, Core fill 500 insulation.
      a. (04.2200.04) 8" x 8" x 16" CMU common block
      b. (07.2140.01) Cavity insulation; Core-Fill 500

3.02 INTEGRATED MASONRY WALL SYSTEMS - RATED

A. (13.4300.340) Wall Type 340
   1. Wall type 340, 8" CMU, Core fill 500 insulation; 2 hour rated.
      a. (04.2200.04) 8" x 8" x 16" CMU common block
      b. (04.2200.02) 2 Hour Rated Units: ASTM C90, normal weight.
         1) Hollow block, as indicated.
      c. (07.2140.01) Cavity insulation; Core-Fill 500
      d. (04.2200.02) 2 Hour Rated Units: ASTM C90, normal weight.
      e. (04.2200.113) Mortar for fire rated wall assemblies: Type M or S
      f. Portland cement stucco or gypsum plaster; 3/4" thick, add 1/2 hr. to classification if used
      g. Where combustible members are framed in wall, plaster or stucco must be applied on the face opposite framing to achieve a maximum classification of 1-1/2hr. attached to concrete blocks.
      h. Loose masonry fill -- if all core spaces are filled with loose dry expanded slag, expanded clay or shale (rotary kiln process), water repellant vermiculite masonry fill insulation, or silicone treated perlite loose fill insulation, add 2 hours to classification.
      i. U.L. Rating: U905

END OF SECTION

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SECTION 210517

SLEEVES AND SLEEVE SEALS FOR FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sleeves.
2. Sleeve-seal systems.
3. Grout.
4. Silicone sealants.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop.

B. Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, anticorrosion coated or galvanized, with plain ends and integral welded waterstop collar.

C. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

D. PVC Pipe Sleeves: ASTM D1785, Schedule 40.

2.2 SLEEVE-SEAL SYSTEMS

A. Description:

1. Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
2. Designed to form a hydrostatic seal of 20 psig minimum.
3. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size.
4. Pressure Plates: Carbon steel.
5. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, ASTM B633, of length required to secure pressure plates to sealing elements.

2.3 GROUT

A. Description: Nonshrink, for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.4 SILICONE SEALANTS

A. Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant, ASTM C920, Type S, Grade NS, Class 25, Use NT.

B. Silicone, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade P, Class 25, Uses T and NT. Grade P Pourable (self-leveling) formulation is for opening in floors and other horizontal surfaces that are not fire rated.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

2. Using grout or silicone sealant, seal space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.

2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.

3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.

E. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Section 078413 "Penetration Firestopping."

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.

B. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.4 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Interior Partitions:

a. Piping Smaller Than NPS 6 Steel pipe sleeves.

END OF SECTION

SECTION 210518
ESCUTCHEONS FOR FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Steel Type: With polished, chrome-plated finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped steel with polished, chrome-plated finish and spring-clip fasteners.

C. One-Piece, Stamped-Steel Type: With polished, chrome-plated finish and spring-clip fasteners.

D. Split-Plate, Stamped-Steel Type: With polished, chrome-plated finish; concealed hinge; and spring-clip fasteners.

2.2 FLOOR PLATES

A. Split Floor Plates: Steel with concealed hinge.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. Escutcheons for New Piping and Relocated Existing Piping:
   a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep pattern.
   b. Chrome-Plated Piping: One-piece steel with polished, chrome-plated finish.
   c. Insulated Piping: One-piece steel with polished, chrome-plated finish.
   d. Insulated Piping: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
   e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece steel with polished, chrome-plated finish.
   f. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
   g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece steel with polished, chrome-plated finish.
   h. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
2. Escutcheons for Existing Piping to Remain:
   a. Chrome-Plated Piping: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
   b. Insulated Piping: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.

c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.

d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping and Relocated Existing Piping: Split floor plate.

2. Existing Piping: Split floor plate.

3.2 FIELD QUALITY CONTROL

A. Using new materials, replace broken and damaged escutcheons and floor plates.

END OF SECTION

SECTION 210523

GENERAL-DUTY VALVES FOR WATER-BASED FIRE-SUPPRESSION 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. Two-piece ball valves with indicators.
2. Bronze butterfly valves with indicators.
3. Iron butterfly valves with indicators.
4. Check valves.
5. Bronze OS&Y gate valves.
6. Iron OS&Y gate valves.
7. NRS gate valves.
8. Indicator posts.
9. Trim and drain valves.

1.3 DEFINITIONS

A. NRS: Nonrising stem.

B. OS&Y: Outside screw and yoke.

C. SBR: Styrene-butadiene rubber.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, and weld ends.
3. Set valves open to minimize exposure of functional surfaces.

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 operating handles or stems as lifting or rigging points.

D. Protect flanges and specialties from moisture and dirt.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain each type of valve from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. UL Listed: Valves shall be listed in UL's "Online Certifications Directory" under the headings listed below and shall bear UL mark:

1. Fire Main Equipment: HAMV - Main Level
    a. Indicator Posts, Gate Valve: HCBZ - Level 1
    b. Ball Valves, System Control: HLUG - Level 3
    c. Butterfly Valves: HLXS - Level 3
    d. Check Valves: HMER - Level 3
    e. Gate Valves: HMRZ - Level 3
2. Sprinkler System & Water Spray System Devices: VDGT - Main Level
    a. Valves, Trim and Drain: VQGU - Level 1

B. FM Global Approved: Valves shall be listed in its "Approval Guide," under the headings listed below:

1. Automated Sprinkler Systems:
    a. Indicator posts.
    b. Valves.
        1) Gate valves.
        2) Check valves
        3) Miscellaneous valves.

C. ASME Compliance:

1. ASME B1.20.1 for threads for threaded-end valves.
2. ASME B16.1 for flanges on iron valves.
3. ASME B31.9 for building services piping valves.

D. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.

E. NFPA Compliance for valves:

1. Comply with NFPA 13, NFPA 14, NFPA 20, and NFPA 24.

F. Valve Pressure Ratings: Not less than the minimum pressure rating indicated or higher, as required by system pressures.

G. Valve Sizes: Same as upstream piping unless otherwise indicated.

H. Valve Actuator Types:

1. Worm-gear actuator with handwheel for quarter-turn valves, except for trim and drain valves.
2. Handwheel: For other than quarter-turn trim and drain valves.
3. Handlever: For quarter-turn trim and drain valves NPS 2 and smaller.

2.3 TWO-PIECE BALL VALVES WITH INDICATORS

A. Nibco Inc.

B. Description:

1. UL 1091, except with ball instead of disc and FM Global approved for indicating valves (butterfly or ball type), Class Number 1112.
2. Minimum Pressure Rating: 175 psig.
3. Body Design: Two piece.
4. Body Material: Forged brass or bronze.

5. Port Size: Full or standard.
6. Seats: PTFE.
7. Stem: Bronze or stainless steel.
8. Ball: Chrome-plated brass.
9. Actuator: Worm gear
10. Supervisory Switch: Internal or external.
11. End Connections for Valves NPS 1 through NPS 2: Threaded ends.
12. End Connections for Valves NPS 2-1/2: Grooved ends.

2.4 BRONZE BUTTERFLY VALVES WITH INDICATORS

A. Globe Fire Sprinkler Corp.

B. Description:

1. Standard: UL 1091 and FM Global standard for indicating valves, (butterfly or ball type), Class Number 1112.
2. Minimum: Pressure rating: 175 psig.
3. Body Material: Bronze.
4. Seat Material: EPDM.
5. Stem Material: Bronze or stainless steel.
6. Disc: **Bronze**.
7. Actuator: Worm gear.
8. Supervisory Switch: Internal or external.
9. Ends Connections for Valves NPS 1 through NPS 2: Threaded ends.
10. Ends Connections for Valves NPS 2-1/2: Grooved ends.

2.5 IRON BUTTERFLY VALVES WITH INDICATORS

A. Globe Fire Sprinkler Corp.

B. Description:

1. Standard: UL 1091 and FM Global standard for indicating valves, (butterfly or ball type), Class Number 112.
2. Minimum Pressure Rating: 175 psig.
3. Body Material: Cast or ductile iron.
4. Seat Material: EPDM.
5. Stem: Stainless steel.
6. Disc: Ductile iron, **nickel plated**.
7. Actuator: Worm gear.
8. Supervisory Switch: Internal or external.
9. Body **Design: Lug or wafer.**

2.6 CHECK VALVES

A. Globe Fire Sprinkler Corp.

B. Description:

1. Standard: UL 312 and FM Global standard for swing check valves, Class Number 1210.
2. Minimum Pressure Rating: 175 psig.
3. Type: Single swing check.

4. Body Material: Cast iron, ductile iron, or bronze.
5. Clapper: Bronze, ductile iron, or stainless steel.
6. Clapper Seat: Brass, bronze, or stainless steel.
7. Hinge Shaft: Bronze or stainless steel.
8. Hinge Spring: Stainless steel.
9. End Connections: Flanged, grooved, or threaded.

2.7 BRONZE OS&Y GATE VALVES

A. Nibco Inc.

B. Description:

1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
2. Minimum Pressure Rating: 175 psig.
3. Body and Bonnet Material: Bronze or brass.
4. Wedge: One-piece bronze or brass.
5. Wedge Seat: Bronze.
6. Stem: Bronze or brass.
7. Packing: Non-asbestos PTFE.
8. Supervisory Switch: External.
9. End Connections: Threaded.

2.8 IRON OS&Y GATE VALVES

A. Victaulic Co.

B. Description:

1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
2. Minimum Pressure Rating: 175 psig.
3. Body and Bonnet Material: Cast or ductile iron.
4. Wedge: Cast or ductile iron, or bronze.
5. Wedge Seat: Cast or ductile iron, or bronze.
6. Stem: Brass or bronze.
7. Packing: Non-asbestos PTFE.
8. Supervisory Switch: External.
9. End Connections: Flanged, Grooved or Threaded.

2.9 NRS GATE VALVES

A. Victaulic Co.

B. Description:

1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
2. Minimum Pressure Rating: 175 psig.
3. Body and Bonnet Material: Cast or ductile iron.
4. Wedge: Cast or ductile iron.
5. Wedge Seat: Cast or ductile iron, or bronze.
6. Stem: Brass or bronze.

7. Packing: Non-asbestos PTFE.
8. Supervisory Switch: External.
9. End Connections: Flanged,Grooved or Threaded.

2.10 INDICATOR POSTS

A. American Cast Iron Pipe Co

B. Description:

1. Standard: UL 789 and FM Global standard for indicator posts.
2. Type: Underground or Wall.
3. Base Barrel Material: Cast or ductile iron.
4. Extension Barrel: Cast or ductile iron.
5. Cap: Cast or ductile iron.
6. Operation: Handwheel.

2.11 TRIM AND DRAIN VALVES

A. Ball Valves:

1. Victaulic Co
2. Description:
   a. Pressure Rating: 175 psig.
   b. Body Design: Two piece.
   c. Body Material: Forged brass or bronze.
   d. Port size: Full or standard.
   e. Seats: PTFE.
   f. Stem: Bronze or stainless steel.
   g. Ball: Chrome-plated brass.
   h. Actuator: Handlever.
   i. End Connections for Valves NPS 1 through NPS 2-1/2: Threaded ends.
   j. End Connections for Valves NPS 1-1/4 and NPS 2-1/2: Grooved ends.

B. Angle Valves:

1. Victaulic Co.
2. Description:
   a. Pressure Rating: 175 psig.
   b. Body Material: Brass or bronze.
   c. Ends: Threaded.
   d. Stem: Bronze.
   e. Disc: Bronze.
   f. Packing: Asbestos free.
   g. Handwheel: Malleable iron, bronze, or aluminum.

C. Globe Valves:

1. Victaulic Co.
2. Description:
   a. Pressure Rating: 175 psig.
   b. Body Material: Bronze with integral seat and screw-in bonnet.

c. Ends: Threaded.

d. Stem: Bronze.

e. Disc Holder and Nut: Bronze.

f. Disc Seat: Nitrile.

g. Packing: Asbestos free.

h. Handwheel: Malleable iron, bronze, or aluminum.

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 INSTALLATION, GENERAL

A. Comply with requirements in the following Sections for specific valve-installation requirements and applications:

1. Section 211100 "Facility Fire-Suppression Water-Service Piping" for application of valves in fire-suppression water-service piping.

2. Section 211200 "Fire-Suppression Standpipes" for application of valves in fire-suppression standpipes.

3. Section 211313 "Wet-Pipe Sprinkler Systems" for application of valves in wet-pipe, fire-suppression sprinkler systems.

4. Section 211316 "Dry-Pipe Sprinkler Systems" for application of valves in dry-pipe, fire-suppression sprinkler systems.

5. Section 211339 "Foam-Water Systems" for application of valves in AFFF piping.

B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply, except from fire-department connections. Install permanent identification signs, indicating portion of system controlled by each valve.

C. Install double-check valve assembly in each fire-protection water-supply connection.

D. Install valves having threaded connections with unions at each piece of equipment arranged to allow easy access, service, maintenance, and equipment removal without system shutdown. Provide separate support where necessary.

E. Install valves in horizontal piping with stem at or above the pipe center.

F. Install valves in position to allow full stem movement.

G. Install valve tags. Comply with requirements in Section 210553 "Identification for Fire-Suppression Piping and Equipment" for valve tags and schedules and signs on surfaces concealing valves; and the NFPA standard applying to the piping system in which valves are installed. Install permanent identification signs indicating the portion of system controlled by each valve.

END OF SECTION

SECTION 210529

HANGERS AND SUPPORTS FOR FIRE SUPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal hanger-shield inserts.
4. Fastener systems.
5. Equipment supports.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section 210516 "Expansion Fittings and Loops for Fire-Suppression Piping" for pipe guides and anchors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show fabrication and installation details and include calculations.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.4 QUALITY ASSURANCE

A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.

B. Pipe Welding Qualifications: Qualify procedures and operators according to "2015 ASME Boiler and Pressure Vessel Code, Section IX."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design trapeze pipe hangers and equipment supports.

B. Structural Performance: Hangers and supports for fire-suppression piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. NFPA Compliance: Comply with NFPA 13.

D. UL Compliance: Comply with UL 203.

2.2 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: Factory-fabricated components, NFPA approved, UL listed, or FM approved for fire-suppression piping support.
2. Galvanized Metallic Coatings: Pregalvanized or hot-dip galvanized.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Copper Pipe and Tube Hangers:

1. Description: Copper-coated-steel, factory-fabricated components, NFPA approved, UL listed, or FM approved for fire-suppression piping support.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly, made from structural-carbon-steel shapes, with NFPA-approved, UL-listed, or FM-approved carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.4 THERMAL HANGER-SHIELD INSERTS

A. Insulation-Insert Material: Water-repellent-treated, ASTM C533, Type I calcium silicate with 100-psi minimum compressive strength.

B. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

C. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

D. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.5 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: NFPA-approved, UL-listed, or FM-approved 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: NFPA-approved, UL-listed, or FM-approved, insert-wedge-type anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Indoor Applications: Zinc-coated steel.
2. Outdoor Applications: Stainless steel.

2.6 EQUIPMENT SUPPORTS

A. Description: NFPA-approved, UL-listed, or FM-approved, welded, shop- or field-fabricated equipment support, made from structural-carbon-steel shapes.

2.7 MATERIALS

A. Aluminum: ASTM B221.

B. Carbon Steel: ASTM A1011/A1011M.

C. Structural Steel: ASTM A36/A36M, carbon-steel plates, shapes, and bars; black and galvanized.

D. Stainless Steel: ASTM A240/A240M.

E. Grout: ASTM C1107/C1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout, suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation, for penetrations through fire-rated walls, ceilings, and assemblies.

B. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

3.2 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with installation requirements of approvals and listings. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size, or install intermediate supports for smaller-diameter pipes as specified for individual pipe hangers.

2. Field fabricate from ASTM A36/A36M carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Thermal Hanger-Shield Installation: Install in pipe hanger or shield for insulated piping.

D. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete, after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual. Install in accordance with approvals and listings.

2. Install mechanical-expansion anchors in concrete, after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions. Install in accordance with approvals and listings.

E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

G. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

H. Install lateral bracing with pipe hangers and supports to prevent swaying.

I. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 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.

J. Load Distribution: Install hangers and supports, so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

L. Insulated Piping:

1. Attach clamps and spacers to piping.

   a. Piping Operating Above Ambient Air Temperature: Clamp may project through insulation.

   b. Piping Operating Below Ambient Air Temperature: Use thermal hanger-shield insert with clamp sized to match OD of insert.

   c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39 protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

   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 or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.

6. Thermal Hanger Shields: Install with insulation of 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 bearing surface smooth.

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/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work.

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 1-1/2 inches.

3.6 PAINTING

A. Touchup: Clean field welds and abraded, shop-painted areas. Paint exposed areas immediately after erecting hangers and supports. Use same materials as those used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

   1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded, shop-painted areas on miscellaneous metal are specified in Section 099123 "Interior Painting."

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing-repair paint to comply with ASTM A780/A780M.

3.7 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with NFPA requirements 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 finishes.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.

F. Use thermal hanger-shield inserts for insulated piping and tubing.

G. Horizontal-Piping Hangers and Supports: Comply with NFPA requirements. Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Steel Pipe Clamps (MSS Type 4): For suspension of NPS 1/2 to NPS 24 if little or no insulation is required.
3. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
4. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
5. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
6. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
7. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
8. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
9. 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.

H. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

I. Hanger-Rod Attachments: Comply with NFPA requirements.

J. Building Attachments: Comply with NFPA requirements. 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. C-Clamps (MSS Type 23): For structural shapes.
3. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

K. Saddles and Shields: Comply with NFPA requirements. 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.

L. Comply with NFPA requirements for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

END OF SECTION

SECTION 210553

IDENTIFICATION FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Stencils.
5. Valve tags.
6. Warning tags.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment-Label Schedule: Include a listing of all equipment to be labeled and the proposed content for each label.

D. Valve Schedules: Valve numbering scheme.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Brady Corp
2. Material and Thickness: stainless steel, 0.025 inch thick, with predrilled holes for attachment hardware.
3. Letter Color: Black.
4. Background Color: White.
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. Plastic Labels for Equipment:

1. Brady Corp.
2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, with predrilled holes for attachment hardware.
3. Letter Color: Black.
4. Background Color: White.

5. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
6. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
7. 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.
8. Fasteners: Stainless-steel rivets or self-tapping screws.
9. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

D. Equipment-Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Brady Corp.

B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, with predrilled holes for attachment hardware.

C. Letter Color: Black.

D. Background Color: White.

E. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

G. 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.

H. Fasteners: Stainless-steel rivets or self-tapping screws.

I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

J. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. Brady Corp.

B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service and showing flow direction according to ASME A13.1.

C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

D. Self-adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

E. Pipe-Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.

2. Lettering Size: Size letters according to ASME A13.1 for piping at least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.

F. Pipe-Label Colors:

1. Background Color: Safety Red.

2. Letter Color: White.

2.4 STENCILS

A. Stencils for Piping:

1. Brimar Industries Inc.

2. Lettering Size: Size letters according to ASME A13.1 for piping at least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.

3. Stencil Material: Fiberboard or metal.

4. Stencil Paint: Safety Red, exterior, gloss, acrylic enamel. Paint may be in pressurized spray-can form.

5. Identification Paint: White, exterior, acrylic enamel. Paint may be in pressurized spray-can form.

2.5 VALVE TAGS

A. Brady Corp.

B. Description: Stamped or engraved with 1/4-inch letters for piping-system abbreviation and 1/2-inch numbers.

1. Tag Material: stainless steel, 0.025 inch thick, with predrilled holes for attachment hardware.

2. Fasteners: Brass wire-link chain.

3. Valve-Tag Color: Safety Red.

4. Letter Color: White.

C. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

2.6 WARNING TAGS

A. Brady Corp.

B. Description: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: 3 by 5-1/4 inches minimum approximately 4 by 7 inches.

2. Fasteners: Brass grommet and wire.

3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."

4. Color: Safety Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of incompatible primers, paints, and encapsulants, as well as dirt, oil, grease, release agents, and other substances that could impair bond of identification devices.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be installed.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.3 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.4 PIPE LABEL INSTALLATION

A. Piping: Painting of piping is specified in Section 099123 "Interior Painting."

B. Stenciled Pipe-Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, with painted, color-coded bands or rectangles on each piping system.

1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

C. Pipe-Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection excluding short takeoffs. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit a 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.

D. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes including pipes where flow is allowed in both directions.

3.5 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in fire-suppression piping systems. List tagged valves in a valve-tag schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and with captions similar to those indicated in "Valve-Tag Size and Shape" Subparagraph below:

1. Valve-Tag Size and Shape:
   a. Fire-Suppression Standpipe: 1-1/2 inches, round.
   b. Wet-Pipe Sprinkler System: 1-1/2 inches, round.
   c. Dry-Pipe Sprinkler System: 1-1/2 inches, round.

d. Clean-Agent Fire-Extinguishing System: 1-1/2 inches, round.

3.6 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION

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SECTION 211100
FACILITY FIRE-SUPPRESSION WATER-SERVICE 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 fire-suppression water-service piping and related components outside the building and service entrance piping through floor into the building and the following:

1. Pipes, fittings, and specialties.
2. Fire-suppression specialty valves.
3. Concrete vaults.
4. Protective enclosures.
5. Alarm devices.

B. Utility-furnished products include water meters that are furnished to the site, ready for installation.

C. Related Requirements:

1. Section 211119 "Fire-Department Connections" for exposed fire-department connections.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Detail precast concrete vault assemblies and indicate dimensions, method of field assembly, and components.
2. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: For piping and specialties including relation to other services in same area, drawn to scale. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.

B. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with requirements of utility company supplying the water. Include tapping of water mains and backflow prevention.
2. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with FM Global's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

E. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-suppression water-service piping.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:

1. Ensure that valves are dry and internally protected against rust and corrosion.
2. Protect valves against damage to threaded ends and flange faces.
3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves, including fire hydrants, according to the following:

1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
2. Protect from weather. Store indoors and maintain temperature higher than ambient dew point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

F. Protect flanges, fittings, and specialties from moisture and dirt.

G. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.7 PROJECT CONDITIONS

A. Interruption of Existing Fire-Suppression Water-Service Piping: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without Owner's written permission.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Soft Copper Tube: ASTM B88, Type K and ASTM B88, Type L, water tube, annealed temper.

B. Hard Copper Tube: ASTM B88, Type K and ASTM B88, Type L, water tube, drawn temper.

C. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.

D. Copper, Pressure-Seal Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

   a. Viega LLC.

2. Standard: UL 213.
3. NPS 2 and Smaller: Wrought-copper fitting with EPDM O-ring seal in each end.
4. NPS 2-1/2 to NPS 4: Bronze fitting with stainless-steel grip ring and EPDM O-ring seal in each end.

E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.

F. 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.

2.2 DUCTILE-IRON PIPE AND FITTINGS

A. Grooved-Joint, Ductile-Iron Pipe: AWWA C151, with cut, rounded-grooved ends.

B. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end.

C. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end.

D. Grooved-End, Ductile-Iron Pipe Appurtenances:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Anvil International/Smith-Cooper International; Tailwind Capital, LLC.

b. CPS Products, Inc.

c. Shurjoint; a part of Aalberts Integrated piping Systems.

d. Smith-Cooper International.

e. Star Pipe Products.

f. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America.

g. Venus Fire Protection Ltd.

h. Victaulic Company.

i. Viking Corporation.

2. Grooved-End, Ductile-Iron Fittings: ASTM A47/A47M, malleable-iron castings or ASTM A536, ductile-iron castings with dimensions matching pipe.
3. Grooved-End, Ductile-Iron-Piping Couplings: AWWA C606, for ductile-iron-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.

E. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

1. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

F. Push-on-Joint, Ductile-Iron Fittings: AWWA C153, ductile-iron compact pattern.

1. Gaskets: AWWA C111, rubber.

G. Flanges: ASME B16.1, Class 125, cast iron.

2.3 PE PIPE AND FITTINGS

A. PE, Fire-Service Pipe: FM Global approved, with minimum thickness equivalent to Class 150 and Class 200.
B. Molded PE Fittings: FM Global approved; PE butt-fusion type, made to match PE pipe dimensions and class.

2.4 SPECIAL PIPE FITTINGS

A. Ductile-Iron Flexible Expansion Joints:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. EBAA Iron, Inc.

b. Romac Industries, Inc.

c. Star Pipe Products.

d. Zurn Industries, LLC.

2. Description: Compound, ductile-iron fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include two gasketed ball-joint sections and one or more gasketed sleeve sections. Assemble components for offset and expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
3. Pressure Rating: 250 psig minimum.

B. Ductile-Iron Deflection Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. EBAA Iron, Inc.

2. Description: Compound, ductile-iron coupling fitting with sleeve and one or two flexing sections for up to 15-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
3. Pressure Rating: 250 psig minimum.

2.5 ENCASEMENT FOR PIPING

A. Standard: ASTM A674 or AWWA C105.
B. Material: Linear low-density PE film of 0.008-inch minimum thickness.
C. Form: tube.
D. Color: Black.

2.6 JOINING MATERIALS

A. Gaskets for Ferrous Piping and Copper-Alloy Tubing: ASME B16.21, asbestos free.
B. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series.
C. Bonding Adhesive for Fiberglass Piping: As recommended by fiberglass piping manufacturer.

2.7 PIPING SPECIALTIES

A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.
B. Tubular-Sleeve Pipe Couplings:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Cascade Waterworks Mfg. Co.
      b. Dresser, Inc.
      c. Ford Meter Box Company, Inc. (The).
      d. Jay R. Smith Mfg Co; a division of Morris Group International.
      e. JCM Industries, Inc.
      f. Romac Industries, Inc.
      g. Viking Johnson.
   2. Description: Metal, bolted, sleeve-type, reducing or transition coupling, with center sleeve, gaskets, end rings, and bolt fasteners, and with ends of same sizes as piping to be joined.
   3. Standard: AWWA C219.
   4. Center-Sleeve Material: Ductile iron.
   5. Gasket Material: Natural or synthetic rubber.
   6. Pressure Rating: 150 psig minimum.
   7. Metal Component Finish: Corrosion-resistant coating or material.

2.8 CORPORATION VALVES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. A.Y. McDonald Mfg. Co.
   2. Ford Meter Box Company, Inc. (The).
   3. Jones, James Company.
   4. Master Meter, Inc.
   5. Mueller Co.
   6. Red Hed Manufacturing Company; a division of Everett J. Prescott, Inc.

B. Corporation Valves: Comply with AWWA C800. Include saddle and valve compatible with tapping machine.

1. Service Saddle: Copper alloy with seal and AWWA C800, threaded outlet for corporation valve.
2. Corporation Valve: Bronze body and ground-key plug, with AWWA C800, threaded inlet and outlet matching service piping material.
3. Manifold: Copper fitting with two to four inlets as required, with ends matching corporation valves and outlet matching service piping material.

C. Meter Valves: Comply with AWWA C800 for high-pressure, service-line valves. Include angle- or straight-through-pattern bronze body, ground-key plug or ball, and wide tee head, with inlet and outlet matching service piping material.

2.9 CURB VALVES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. A.Y. McDonald Mfg. Co.
2. Ford Meter Box Company, Inc. (The).
3. Jones, James Company.
4. Master Meter, Inc.
5. Mueller Co.
6. Red Hed Manufacturing Company; a division of Everett J. Prescott, Inc.

B. Curb Valves: Comply with AWWA C800 for high-pressure, service-line valves. Valve has bronze body, ground-key plug or ball, wide tee head, and inlet and outlet matching service piping material.

C. Service Boxes for Curb Valves: Similar to AWWA M44 requirements for cast-iron valve boxes. Include cast-iron telescoping top section of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over curb valve and with a barrel approximately 3 inches in diameter.

1. Shutoff Rods: Steel; with tee-handle with one pointed end, stem of length to operate deepest buried valve, and slotted end matching curb valve.

D. Meter Valves: Comply with AWWA C800 for high-pressure, service-line valves. Include angle- or straight-through-pattern bronze body, ground-key plug or ball, and wide tee head, with inlet and outlet matching service piping material.

2.10 DETECTOR CHECK VALVES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ames Fire & Waterworks; A WATTS Brand.
2. Badger Meter, Inc.
3. FEBCO; A WATTS Brand.
4. Flomatic Corporation.
5. Globe Fire Sprinkler Corporation.
6. Kennedy Valve Company; a division of McWane, Inc.
7. Mueller Co.
8. Victaulic Company.
9. Viking Corporation.
10. WATTS.
11. Zurn Industries, LLC.

B. Description: Galvanized cast-iron body, bolted cover with air-bleed device for access to internal parts, and flanged ends. Include one-piece bronze disc with bronze bushings, pivot, and replaceable seat. Include threaded bypass taps in inlet and outlet for bypass meter connection. Set valve to allow minimal water flow through bypass meter when major water flow is required.

C. Standards: UL 312 and FM Global's "Approval Guide."

D. Pressure Rating: 175 psig.

E. Water Meter: AWWA C700, disc type, at least one-fourth size of detector check valve. Include meter, bypass piping, gate valves, check valve, and connections to detector check valve.

2.11 WATER METERS

A. Water meters are furnished by utility company.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AMCO Water Metering Systems.
2. Badger Meter, Inc.
3. Carlon Meter.
4. Hays Fluid Controls.
5. McCrometer, Inc.
6. Mueller Co.
7. Neptune Technology Group Inc.
8. Sensus Metering Systems.

C. Turbine-Type Water Meters:

1. Standard: AWWA C701.
2. Registration: Flow in gallons.

D. Remote Registration System:

1. Description: Utility company's standard; direct-reading type. Include meter modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly.
2. Standard: AWWA C706.
3. Registration: Flow in gallons.

E. Remote Registration System:

1. Description: Utility company's standard; encoder type. Include meter modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly.
2. Standard: AWWA C707.
3. Registration: Flow in gallons.
4. Data-Acquisition Units: Comply with utility company's requirements for type and quantity.
5. Visible Display Units: Comply with utility company's requirements for type and quantity.

2.12 DETECTOR-TYPE WATER METERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Badger Meter, Inc.
2. Mueller Co.
3. Neptune Technology Group Inc.
4. Sensus Metering Systems.

B. AWWA, Detector Check Water Meters:

1. Description: Main line, turbine meter with second meter on bypass.
2. Standard: AWWA C703.
3. Registration: Flow in gallons.
4. Pressure Rating: 150 psig.
5. Bypass Meter: AWWA C701, turbine-type, bronze case.
   a. Size: At least one-half nominal size of main-line meter.

C. Fire-Protection, Detector Check Water Meters:

1. Description: Main-line turbine meter with strainer and second meter on bypass.
2. Standards: UL's "Fire Protection Equipment Directory" listing and FM Global's "Approval Guide."
3. Registration: Flow in gallons.
4. Pressure Rating: 175 psig minimum.
5. Bypass Meter: AWWA C701, turbine-type, bronze case.
   a. Size: At least NPS 2.

D. Remote Registration System:

1. Description: Utility company's standard; direct-reading type. Include meter modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly.
2. Standard: AWWA C706.
3. Registration: Flow in gallons.

E. Remote Registration System:

1. Description: Utility company's standard; encoder type. Include meter modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly.
2. Standard: AWWA C707.
3. Registration: Flow in gallons.
4. Data-Acquisition Units: Comply with utility company's requirements for type and quantity.
5. Visible Display Units: Comply with utility company's requirements for type and quantity.

2.13 PRESSURE-REDUCING VALVES

A. Water Regulators:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
   b. Cash Acme, A Division of Reliance Worldwide Corporation.
   c. Flomatic Corporation.
   d. Honeywell International Inc.
   e. WATTS.
   f. Zurn Industries, LLC.
2. Standard: ASSE 1003.
3. Pressure Rating: Initial pressure of 150 psig.
4. Size: 8” NPS.
5. Design Flow Rate: 1,600 gpm.
6. Design Inlet Pressure: 60 psig.

7. Design Outlet Pressure Setting: Field verify.
8. Body Material: Bronze with chrome-plated finish for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3.
9. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and NPS 3.

B. Water Control Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Ames Fire & Waterworks; A WATTS Brand.
   b. Apollo Valves; a part of Aalberts Integrated Piping Systems.
   c. CLA-VAL.
   d. Flomatic Corporation.
   e. Globe Fire Sprinkler Corporation.
   f. OCV Control Valves.
   g. Reliable Automatic Sprinkler Co., Inc. (The).
   h. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America.
   i. Victaulic Company.
   j. Viking Corporation.
   k. WATTS.
   l. Zurn Industries, LLC.
2. Description: Pilot-operation, diaphragm-type, single-seated main water control valve with AWWA C550 or FDA-approved, interior epoxy coating. Include small pilot control valve, restrictor device, specialty fittings, and sensor piping.
3. Pressure Rating: Initial pressure of 150 psig minimum.
4. Main Valve Body: Cast or ductile iron with AWWA C550 or FDA-approved, interior epoxy coating; or stainless-steel body.
   a. Size: 8” NPS.
   b. Pattern: Globe-valve design.
   c. Trim: Stainless steel.
5. Design Flow Rate: 1,600 gpm.
6. Design Inlet Pressure: 60 psig.
7. Design Outlet Pressure Setting: Field verify.
8. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.

2.14 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Ames Fire & Waterworks; A WATTS Brand.
   b. Apollo Valves; a part of Aalberts Integrated Piping Systems.
   c. FEBCO; A WATTS Brand.
   d. Flomatic Corporation.
   e. Mueller Co.

f. WATTS.

g. Zurn Industries, LLC.

2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 12 psig maximum, through middle one-third of flow range.
5. Size: 8” NPS.
6. Design Flow Rate: 1,600 gpm.
7. Selected Unit Flow Range Limits: 1,600 gpm.
8. Pressure Loss at Design Flow Rate: 8 psig for NPS 2 and smaller; 12 psig for NPS 2-1/2 and larger.
9. Body Material: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
10. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
11. Configuration: Designed for horizontal, straight through flow.
12. Accessories:

    a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; OS&Y gate type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.

    b. Air-Gap Fitting: ASME A112.1.2, matching backflow preventer connection.

B. Double-Check, Backflow-Prevention Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Ames Fire & Waterworks; A WATTS Brand.

    b. Apollo Valves; a part of Aalberts Integrated Piping Systems.

    c. FEBCO; A WATTS Brand.

    d. Flomatic Corporation.

    e. Mueller Co.

    f. WATTS.

    g. Zurn Industries, LLC.

2. Standard: ASSE 1015 or AWWA C510.
3. Operation: Continuous-pressure applications unless otherwise indicated.
4. Pressure Loss: 5 psig maximum, through middle one-third of flow range.
5. Size: 8” NPS.
6. Design Flow Rate: 1,600 gpm.
7. Selected Unit Flow Range Limits: 1,600 gpm.
8. Pressure Loss at Design Flow Rate: 8 psig for NPS 2 and smaller; 12 psig for NPS 2-1/2 and larger.
9. Body Material: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
10. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
11. Configuration: Designed for horizontal, straight through flow.
12. Accessories: Ball valves with threaded ends on inlet and outlet of NPS 2 and smaller; OS&Y gate valves with flanged ends on inlet and outlet of NPS 2-1/2 and larger.

C. Reduced-Pressure-Detector, Fire-Protection Backflow Preventer Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Ames Fire & Waterworks; A WATTS Brand.
    b. Apollo Valves; a part of Aalberts Integrated Piping Systems.
    c. FEBCO; A WATTS Brand.
    d. WATTS.
    e. Zurn Industries, LLC.
2. Standards: ASSE 1047 and UL's "Fire Protection Equipment Directory" listing or FM Global's "Approval Guide."
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 12 psig maximum, through middle one-third of flow range.
5. Size: 8” NPS.
6. Design Flow Rate: 1,600 gpm.
7. Selected Unit Flow Range Limits: 1,600 gpm.
8. Pressure Loss at Design Flow Rate: field verify psig.
9. Body Material: Cast iron with interior lining complying with AWWA C550 or that is FDA approved.
10. End Connections: Flanged.
11. Configuration: Designed for horizontal, straight through flow.
12. Accessories:
    a. Valves: UL 262 and FM Global's "Approval Guide" listing; OS&Y gate type with flanged ends on inlet and outlet.
    b. Air-Gap Fitting: ASME A112.1.2, matching backflow preventer connection.
    c. Bypass: With displacement-type water meter, shutoff valves, and reduced-pressure backflow preventer.

D. Double-Check, Detector-Assembly Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Ames Fire & Waterworks; A WATTS Brand.
    b. Apollo Valves; a part of Aalberts Integrated Piping Systems.
    c. FEBCO; A WATTS Brand.
    d. Mueller Co.
    e. WATTS.
    f. Zurn Industries, LLC.
2. Standards: ASSE 1048 and UL's "Fire Protection Equipment Directory" listing or FM Global's "Approval Guide."
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 5 psig maximum, through middle one-third of flow range.
5. Size: 8” NPS.
6. Design Flow Rate: 1,600 gpm.
7. Selected Unit Flow Range Limits: 1,600 gpm.
8. Pressure Loss at Design Flow Rate: field verify psig.

9. Body Material: Cast iron with interior lining complying with AWWA C550 or that is FDA approved.
10. End Connections: Flanged.
11. Configuration: Designed for horizontal, straight through flow.
12. Accessories:
    a. Valves: UL 262 and FM Global's "Approval Guide" listing; OS&Y gate type with flanged ends on inlet and outlet.
    b. Bypass: With displacement-type water meter, shutoff valves, and reduced-pressure backflow preventer.

E. Backflow Preventer Test Kits:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Ames Fire & Waterworks; A WATTS Brand.
    b. Apollo Valves; a part of Aalberts Integrated Piping Systems.
    c. FEBCO; A WATTS Brand.
    d. Flomatic Corporation.
    e. WATTS.
    f. Zurn Industries, LLC.
2. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions.

2.15 ALARM DEVICES

A. General: UL 753 and FM Global's "Approval Guide" listing, of types and sizes to mate and match piping and equipment.

B. Water-Flow Indicators: Vane-type water-flow detector, rated for 250-psig working pressure; designed for horizontal or vertical installation; with two single-pole, double-throw circuit switches to provide isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal when cover is removed.

C. Supervisory Switches: Single pole, double throw; designed to signal valve in other than fully open position.

D. Pressure Switches: Single pole, double throw; designed to signal increase in pressure.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Comply with excavating, trenching, and backfilling requirements in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

A. Water-Main Connection: Arrange with water utility company for tap of size and in location indicated in water main.

B. Water-Main Connection: Tap water main according to requirements of water utility company and of size and in location indicated.

C. Make connections larger than NPS 2 with tapping machine according to the following:
1. Install tapping sleeve and tapping valve according to MSS SP-60.
2. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
3. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.

4. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.

D. Make connections NPS 2 and smaller with drilling machine according to the following:

1. Install service-saddle assemblies and corporation valves in size, quantity, and arrangement required by utility company's standards.
2. Install service-saddle assemblies on water-service pipe to be tapped. Position outlets for corporation valves.
3. Use drilling machine compatible with service-saddle assemblies and corporation valves. Drill hole in main. Remove drilling machine and connect water-service piping.
4. Install corporation valves into service-saddle assemblies.
5. Install manifold for multiple taps in water main.
6. Install curb valve in water-service piping with head pointing up and with service box.

E. Comply with NFPA 24 for fire-service-main piping materials and installation.

F. Install copper tube and fittings according to CDA's "Copper Tube Handbook."

1. Install encasement for tubing according to ASTM A674 or AWWA C105.

G. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.

1. Install encasement for piping according to ASTM A674 or AWWA C105.

H. Install PE pipe according to ASTM D2774 and ASTM F645.

I. Install PVC, AWWA pipe according to ASTM F645 and AWWA M23.

J. Install fiberglass AWWA pipe according to AWWA M45.

K. Bury piping with depth of cover over top at least 48 inches, with top at least 12 inches below level of maximum frost penetration, and according to the following:

1. Under Driveways: With at least 48 inche**s** of cover over top.
2. In Loose Gravelly Soil and Rock: With at least 48 inches of additional cover.

L. Install piping by tunneling or jacking, or combination of both, under streets and other obstructions that cannot be disturbed.

M. Extend fire-suppression water-service piping and connect to water-supply source and building fire-suppression water-service piping systems at locations and pipe sizes indicated.

1. Terminate fire-suppression water-service piping within the building at the floor slab until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building's fire-suppression water-service piping systems when those systems are installed.

N. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.

O. Comply with requirements for fire-suppression water-service piping inside the building in the following Sections:

1. Section 211316 "Dry-Pipe Sprinkler Systems"

P. Comply with requirements in Section 221116 "Domestic Water Piping" for potable-water piping inside the building.

Q. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

R. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

3.3 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure rating same as or higher than systems pressure rating for aboveground applications unless otherwise indicated.

B. Install unions adjacent to each valve in tubing NPS 2 and smaller.

C. Install flanges, flange adaptors, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

D. Ream ends of tubes and remove burrs.

E. Remove scale, slag, dirt, and debris from outside and inside of pipes, tubes, and fittings before assembly.

F. Copper-Tubing, Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.

G. Copper-Tubing, Pressure-Sealed Joints: Use proprietary crimping tool and procedure recommended by copper, pressure-seal-fitting manufacturer.

H. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.

I. Ductile-Iron Piping, Grooved Joints: Cut-groove pipe. Assemble joints with grooved-end, ductile-iron-piping couplings, gaskets, lubricant, and bolts.

J. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with bolts according to ASME B31.9.

K. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D2657.

L. PVC Piping Gasketed Joints: Use joining materials according to AWWA C900. Construct joints with elastomeric seals and lubricant according to ASTM D2774 or ASTM D3139.

M. Fiberglass Piping Bonded Joints: Use adhesive and procedure recommended by piping manufacturer.

N. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure.

O. Do not use flanges or unions for underground piping.

3.4 ANCHORAGE INSTALLATION

A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:

1. Concrete thrust blocks.
2. Locking mechanical joints.
3. Set-screw mechanical retainer glands.
4. Bolted flanged joints.
5. Heat-fused joints.
6. Pipe clamps and tie rods.

B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches in fire-suppression water-service piping according to NFPA 24 and the following:

1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
2. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.
3. Bonded-Joint Fiberglass, Water-Service Piping: According to AWWA M45.

C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.5 VALVE INSTALLATION

A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.

B. AWWA Valves Other Than Gate Valves: Comply with AWWA C600 and AWWA M44.

C. UL-Listed or FM Global-Approved Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.

D. UL-Listed or FM Global-Approved Valves Other Than Gate Valves: Comply with NFPA 24.

E. MSS Valves: Install as component of connected piping system.

F. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.

G. Pressure-Reducing Valves: Install in vault or aboveground between shutoff valves. Install full-size valved bypass.

H. Support valves and piping, not direct buried, on concrete piers. Comply with requirements for concrete piers in Section 033000 "Cast-in-Place Concrete."

3.6 DETECTOR CHECK VALVE INSTALLATION

A. Install in vault or aboveground.

B. Install for proper direction of flow. Install bypass with water meter, gate valves on each side of meter, and check valve downstream from meter.

C. Support detector check valves and piping on concrete piers. Comply with requirements for concrete piers in Section 033000 "Cast-in-Place Concrete."

3.7 WATER METER INSTALLATION

A. Install water meters, piping, and specialties according to utility company's written instructions.

B. Water Meters: Install turbine-type water meters NPS 3 and larger in meter vaults. Include shutoff valves on water meter inlets and outlets, and include valved bypass around meters. Support meters, valves, and piping on brick or concrete piers.

C. Water Meters: Install detector-type water meters in meter vault according to AWWA M6. Include shutoff valves on water meter inlets and outlets, and include full-size valved bypass around meters. Support meters, valves, and piping on brick or concrete piers.

D. Support water meters and piping NPS 3 and larger on concrete piers. Comply with requirements for concrete piers in Section 033000 "Cast-in-Place Concrete."

3.8 ROUGHING-IN FOR WATER METERS

A. Rough-in piping and specialties for water meter installation according to utility company's written instructions.

3.9 BACKFLOW PREVENTER INSTALLATION

A. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.

B. Do not install backflow preventers that have relief drain in vault or in other spaces subject to flooding.

C. Do not install bypass piping around backflow preventers.

D. Support NPS 2-1/2 and larger backflow preventers and piping on concrete piers. Comply with requirements for concrete piers in Section 033000 "Cast-in-Place Concrete."

3.10 WATER METER BOX INSTALLATION

A. Install water meter boxes in paved areas flush with surface.

B. Install water meter boxes in grass or earth areas with top 2 inches above surface.

3.11 CONCRETE VAULT INSTALLATION

A. Install precast concrete vaults according to ASTM C891.

3.12 PROTECTIVE ENCLOSURE INSTALLATION

A. Install concrete base level and with top approximately 2 inches above grade.

B. Install protective enclosure over valves and equipment.

C. Anchor protective enclosure to concrete base.

3.13 FIRE-DEPARTMENT CONNECTION INSTALLATION

A. Install ball drip valves at each check valve for fire-department connection to mains.

B. Install protective pipe bollards on two sides of each freestanding fire-department connection. Pipe bollards are specified in Section 055000 "Metal Fabrications."

3.14 ALARM DEVICE INSTALLATION

A. General: Comply with NFPA 24 for devices and methods of valve supervision. Underground valves with valve box do not require supervision.

B. Supervisory Switches: Supervise valves in open position.

1. Valves: Grind away portion of exposed valve stem. Bolt switch, with plunger in stem depression, to OS&Y gate-valve yoke.

2. Indicator Posts: Drill and thread hole in upper-barrel section at target plate. Install switch, with toggle against target plate, on barrel of indicator post.

C. Locking and Sealing: Secure unsupervised valves as follows:

1. Valves: Install chain and padlock on open OS&Y gate valve.

2. Post Indicators: Install padlock on wrench on indicator post.

D. Pressure Switches: Drill and thread hole in exposed barrel of fire hydrant. Install switch.

E. Water-Flow Indicators: Install in water-service piping in vault. Select indicator with saddle and vane matching pipe size. Drill hole in pipe, insert vane, and bolt saddle to pipe.

F. Connect alarm devices to building's fire-alarm system. Wiring and fire-alarm devices are specified in Section 284621.11 "Addressable Fire-Alarm Systems."

3.15 CONNECTIONS

A. Connect fire-suppression water-service piping to utility water main. Use service clamp and corporation valve.

B. Connect fire-suppression water-service piping to interior fire-suppression piping.

C. Connect waste piping from concrete vault drains to sanitary sewerage system**.** Comply with requirements in Section 221313 "Facility Sanitary Sewers" for connection to sanitary sewer system.

3.16 FIELD QUALITY CONTROL

A. Use test procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described below.

B. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

C. Hydrostatic Tests: Test at not less than one-and-one-half times the working pressure for two hours.

1. Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for one hour; decrease to zero psig. Slowly increase again to test pressure and hold for one more hour. Maximum allowable leakage is 2 quarts per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.

D. Prepare test and inspection reports.

3.17 IDENTIFICATION

A. Install continuous underground warning tape during backfilling of trench for underground fire-suppression water-service piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Section 312000 "Earth Moving."

B. Permanently attach equipment nameplate or marker indicating plastic fire-suppression water-service piping or fire-suppression water-service piping with electrically insulated fittings, on main electrical meter panel. Comply with requirements for identifying devices in Section 220553 "Identification for Plumbing Piping and Equipment."

3.18 CLEANING

A. Clean fire-suppression water-service piping as follows:

1. Purge new piping systems and parts of existing systems that have been altered, extended, or repaired before use.

2. Use purging procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.

3. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:

a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow it to stand for 24 hours.
b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow it to stand for three hours.
c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

B. Prepare reports of purging activities.

3.19 PIPING SCHEDULE

A. Underground fire-suppression water-service piping NPS 8 shall be the following:

1. Grooved-end, ductile-iron pipe; grooved-end, ductile-iron pipe appurtenances; and grooved joints.

2. Mechanical-joint, ductile-iron pipe; mechanical-joint, ductile- or gray-iron, standard-pattern or ductile-iron, compact-pattern fittings; glands, gaskets, and bolts; and gasketed joints.

3. Push-on-joint, ductile-iron pipe; push-on-joint, ductile-iron compact-pattern fittings; and gasketed joints.

4. PE, Class 150, fire-service pipe; molded PE fittings; and heat-fusion joints.

B. Aboveground fire-suppression water-service piping NPS 2 and smaller shall be hard copper tube, ASTM B88, Type K; copper, pressure-seal fittings; and pressure-sealed joints.

C. Aboveground fire-suppression water-service piping NPS 3 and NPS 6 shall be one of the following:

1. Hard copper tube, ASTM B88, Type K; copper, pressure-seal fittings; and pressure-sealed joints.
2. Grooved-end, ductile-iron pipe; grooved-end, ductile-iron pipe appurtenances; and grooved joints.

D. Aboveground fire-suppression water-service piping NPS 6 to NPS 8 shall be grooved-end, ductile-iron pipe; grooved-end, ductile-iron pipe appurtenances; and grooved joints.

E. Underslab fire-suppression water-service piping NPS 2 and smaller shall be hard copper tube, ASTM B88, Type K; copper, pressure-seal fittings; and pressure-sealed joints.

F. Underslab fire-suppression water-service piping NPS 6 to NPS 8 shall be one of the following:

1. Grooved-end, ductile-iron pipe; grooved-end, ductile-iron pipe appurtenances; and grooved joints.
2. Mechanical-joint, ductile-iron pipe; mechanical-joint, ductile- or gray-iron, standard-pattern or ductile-iron, compact-pattern fittings; glands, gaskets, and bolts; and restrained, gasketed joints.
3. Push-on-joint, ductile-iron pipe; push-on-joint, ductile-iron compact-pattern fittings; and restrained, gasketed joints.

3.20 VALVE SCHEDULE

A. Underground fire-suppression water-service shutoff valves NPS 2 and smaller shall be corporation valves or curb valves with ends compatible with piping.

B. Meter box fire-suppression water-service shutoff valves NPS 2 and smaller shall be meter valves.

C. Indicator-post underground fire-suppression water-service valves NPS 3 and larger shall be 175-psig, UL-listed or FM Global-approved, iron, nonrising-stem gate valves with indicator-post flange.

D. Standard-pressure, aboveground fire-suppression water-service shutoff valves NPS 3 and larger shall be one of the following:

1. 200-psig, AWWA, iron, OS&Y, metal-seated gate valves.
2. 250-psig, AWWA, iron, OS&Y, resilient-seated gate valves.
3. 175-psig, UL-listed or FM Global-approved, iron, OS&Y gate valves.
4. AWWA or UL-listed or FM Global-approved butterfly valves.

E. Fire-suppression water-service check valves NPS 3 and larger shall be one of the following:

1. AWWA or UL-listed or FM Global-approved check valves.
2. UL-listed or FM Global-approved detector check valves.

END OF SECTION

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SECTION 211119

FIRE DEPARTMENT CONNECTIONS

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. Exposed-type fire-department connections.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each fire-department connection.

PART 2 - PRODUCTS

2.1 EXPOSED-TYPE FIRE-DEPARTMENT CONNECTION

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Fire Hose & Cabinet.
2. Elkhart Brass Mfg. Co., Inc.
3. Fire Protection Products, Inc.
4. Fire-End & Croker Corporation.
5. GMR International Equipment Corporation.
6. Guardian Fire Equipment, Inc.
7. Venus Fire Protection Ltd.
8. Wilson & Cousins Inc.

B. Standard: UL 405.

C. Type: Exposed, projecting, for wall mounting.

D. Pressure Rating: 175 psig minimum.

E. Body Material: Corrosion-resistant metal.

F. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.

G. Caps: Brass, lugged type, with gasket and chain.

H. Escutcheon Plate: Round, brass, wall type.

I. Outlet: Back, with pipe threads.

J. Number of Inlets: Two.

K. Escutcheon Plate Marking: Similar to "AUTO SPKR & STANDPIPE."

L. Finish: Polished chrome plated.

M. Outlet Size: NPS 4.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of fire-department connections.

B. Examine roughing-in for fire-suppression standpipe system to verify actual locations of piping connections before fire-department connection installation.

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

3.2 INSTALLATION

A. Install wall-type fire-department connections.

B. Install two protective pipe bollards in front of each fire-department connection. Comply with requirements for bollards in Section 055000 "Metal Fabrications."

C. Install automatic (ball-drip) drain valve at each check valve for fire-department connection.

END OF SECTION

SECTION 211316
DRY-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Pipes, fittings, and specialties.
2. Specialty valves.
3. Sprinkler specialty pipe fittings.
4. Sprinklers.
5. Alarm devices.
6. Manual control stations.
7. Control panels.
8. Pressure gauges.

B. Related Requirements:

1. Section 211119 "Fire Department Connections" for exposed-, flush-, and yard-type fire department connections.
2. Section 210523 "Fire Protection Piping" for ball, butterfly, check, gate, post-indicator, and trim and drain valves.

1.3 DEFINITIONS

A. Standard-Pressure Sprinkler Piping: Dry-pipe sprinkler system piping designed to operate at working pressure of 175-psig maximum.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For dry-pipe sprinkler systems.

1. Include plans, elevations, sections, and attachment details.
2. Include diagrams for power, signal, and control wiring.

C. Delegated-Design Submittal: For dry-pipe sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Sprinkler systems, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Domestic water piping.
2. Compressed air piping.
3. Items penetrating finished ceiling including the following:

a. Lighting fixtures.
b. Air outlets and inlets.
c. Conveyors and Process equipment.

B. Qualification Data: For qualified Installer and professional engineer.

C. Design Data:

1. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.

D. Fire-hydrant flow test report.

E. Field Test Reports: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."

F. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For dry-pipe sprinkler systems and specialties to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

1.8 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.

a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.

1.9 FIELD CONDITIONS

A. Interruption of Existing Sprinkler Service: Do not interrupt sprinkler service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sprinkler service according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of sprinkler service.

2. Do not proceed with interruption of sprinkler service without Owner's written permission.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTIONS

A. Dry-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing compressed air or nitrogen. Opening of sprinklers releases compressed air or nitrogen and permits water pressure to open dry-pipe valve. Water then flows into piping and discharges from opened sprinklers.

B. Combined Dry-Pipe and Preaction Sprinkler System: Automatic sprinklers are attached to piping containing compressed air or nitrogen. Fire-detection system, located in same area as sprinklers, actuates tripping devices that open dry-pipe valve without loss of air pressure and actuates fire alarm. Water discharges from opened sprinklers.

C. Single-Interlock Preaction Sprinkler System: Automatic sprinklers are attached to piping containing low-pressure air or nitrogen. Actuation of fire-detection system, located in same area as sprinklers, opens pre-action valve, permitting water to flow into sprinkler piping and to discharge from opened sprinklers.

D. Double-Interlock Preaction Sprinkler System: Automatic sprinklers are attached to piping containing low-pressure air or nitrogen. Actuation of a fire-detection system, located in same area as sprinklers, will activate the normally closed solenoid but will not open the pre-action valve. Activation of a sprinkler head will not permit water to flow into sprinkler piping. Activation of both the normally closed solenoid valve and automatic sprinkler is required to cause the pre-action valve to open, permitting water to flow into sprinkler piping, and water will then discharge from opened sprinkler.

2.2 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with **NFPA 13**.

C. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.

D. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design dry-pipe sprinkler systems.

1. Available fire-hydrant flow test records indicate the following conditions:

a. Date: 03/13/2020

b. Time: <**TBD**> [**a.m.**] [**p.m.**]

c. Performed by: <**TBD**> of <**TBD**>.

d. Location of Residual Fire Hydrant R: Hydrant #1.

e. Location of Flow Fire Hydrant F: NW corner of building.

f. Static Pressure at Residual Fire Hydrant R: 100 psig.

g. Measured Flow at Flow Fire Hydrant F: 1353 gpm.

h. Residual Pressure at Residual Fire Hydrant R: 80 psig>.

E. Sprinkler system design shall be approved by authorities having jurisdiction.

1. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.

2. Sprinkler Occupancy Hazard Classifications:

a. Building Service Areas: Ordinary Hazard, Group 1.

b. Office and Public Areas: Light Hazard.

c. Electrical Equipment Rooms: Ordinary Hazard, Group 1.

d. Process: Ordinary Hazard, Group 2.

e. General Storage Areas: Ordinary Hazard, Group 1.

f. Mechanical Equipment Rooms: Ordinary Hazard, Group 1.

g. Plastics Processing Areas: Extra Hazard, Group 2.

3. Minimum Density for Automatic-Sprinkler Piping Design:

a. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. area.

b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. area.

c. Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm over 1500-sq. ft. area.

d. Extra-Hazard, Group 1 Occupancy: 0.30 gpm over 2500-sq. ft. area.

e. Extra-Hazard, Group 2 Occupancy: 0.40 gpm over 2500-sq. ft. area.

f. Special Occupancy Hazard: As determined by authorities having jurisdiction.

4. Maximum protection area per sprinkler according to UL listing.

5. Maximum Protection Area per Sprinkler:

a. Office Spaces: 120 sq. ft..

b. Storage Areas: 130 sq. ft..

c. Mechanical Equipment Rooms: 130 sq. ft..

d. Electrical Equipment Rooms: 130 sq. ft..

e. Other Areas: According to NFPA 13 recommendations unless otherwise indicated.

6. Total Combined Hose-Stream Demand Requirement: According to 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.

c. Extra-Hazard Occupancies: 500 gpm for 90 to 120 minutes.

F. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7. See Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment."

2.3 STEEL PIPE AND FITTINGS

A. Standard-Weight, Galvanized-Steel Pipe: ASTM A53/A53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.

B. Schedule 30, Galvanized-Steel Pipe: ASTM A135/A135M; ASTM A795/A795M, Type E; or ASME B36.10M wrought steel, with wall thickness not less than Schedule 30 and not more than Schedule 40. Pipe ends may be factory or field formed to match joining method.

C. Thinwall Galvanized-Steel Pipe: ASTM A135/A135M or ASTM A795/A795M, threadable, with wall thickness less than Schedule 30 and equal to or greater than Schedule 10. Pipe ends may be factory or field formed to match joining method.

D. Galvanized-Steel Pipe Nipples: ASTM A733, made of ASTM A53/A53M, standard-weight, seamless steel pipe with threaded ends.

E. Galvanized-Steel Couplings: ASTM A865/A865M, threaded.

F. Galvanized, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.

G. Malleable- or Ductile-Iron Unions: UL 860.

H. Cast-Iron Flanges: ASME B16.1, Class 125.

I. Plain-End-Pipe Fittings: UL 213, ductile-iron body with retainer lugs that require one-quarter turn or screwed retainer pin to secure pipe in fitting.

1. International/Smith-Cooper International

2. Grooved-Joint, Steel-Pipe Appurtenances:

3. Victaulic

4. Pressure Rating: 175-psig minimum.

5. Galvanized, Grooved-End Fittings for Steel Piping: ASTM A47/A47M, malleable-iron casting or ASTM A536, ductile-iron casting, with dimensions matching steel pipe.

6. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

2.4 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tube: ASTM B88, Type L and ASTM B88, Type M.

B. Cast-Copper, Solder-Joint Fittings: ASME B16.18 pressure fittings.

C. Wrought-Copper, Solder-Joint Fittings: ASME B16.22 pressure fittings.

D. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

1. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free.

E. 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.

F. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

G. Copper-Tube, Mechanically Formed Tee Fitting: For forming T-branch on copper water tube.

1. T-Drill Industries Inc.

2. Description: Tee formed in copper tube according to ASTM F2014.

H. Grooved, Mechanical-Joint, Copper-Tube Appurtenances:

1. Victaulic Co

2. Standard: UL 213.

3. Grooved-End Copper Fittings: ASTM B75 copper tube or ASTM B584 bronze castings.

4. Grooved-End-Tube Couplings: To fit copper tube dimensions; rigid pattern unless otherwise indicated; gasketed fitting EPDM-rubber gasket rated for minimum 180 deg F for use with ferrous housing and steel bolts and nuts; 300 psig minimum CWP pressure rating.

I. Copper-Tube, Pressure-Seal-Joint Fittings:

1. Viega

2. Fittings: Cast-brass, cast-bronze, or wrought-copper with EPDM O-ring seal in each end.

3. Minimum 200-psigworking-pressure rating at 250 deg F.

2.5 SPECIALTY VALVES

A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

B. Pressure Rating:

1. Standard-Pressure Piping Specialty Valves: 175-psig minimum.

C. Body Material: Cast or ductile iron.

D. Size: Same as connected piping.

E. End Connections: Flanged or grooved.

F. Dry-Pipe Valves:

1. Victaulic Co

2. Standard: UL 260.

3. Design: Differential-pressure type.

4. Include UL 1486, quick-opening devices, trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gauges, priming chamber attachment, and fill-line attachment.

5. Air-Pressure Maintenance Device:

a. Victaulic Co

b. Standard: UL 260.

c. Type: Automatic device to maintain minimum air pressure in piping.

d. Include shutoff valves to permit servicing without shutting down sprinkler piping, bypass valve for quick filling, pressure regulator or switch to maintain pressure, strainer, pressure ratings with 14- to 60-psig adjustable range, and 175-psig outlet pressure.

6. Air Compressor:

a. Viking Corp.

b. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

c. Motor Horsepower: Fractional.

1) Power: 120-V ac, 60 Hz, single phase.

d. Sized for application and capable of achieving system supervisory pressure within 30 minutes in accordance with requirements of NFPA 13. Provide ASME air receiver tank as required to meet requirements on larger systems.

e. Include filters, relief valves, coolers, automatic drains, and gauges.

G. Pre-Action Valves:

1. Victaulic Co

2. Standard: UL 260.

3. Design: Hydraulically operated, differential-pressure type.

4. Include trim sets for alarm-test bypass, drain, electrical water-flow alarm switch, pressure gauges, drip cup assembly piped without valves and separate from main drain line, and fill-line attachment with strainer.

5. Dry, Pilot-Line Trim Set: Include dry, pilot-line actuator; air- and water-pressure gauges; low-air-pressure warning switch; air relief valve; and actuation device. Dry, pilot-line actuator includes cast-iron, operated, diaphragm-type valve with resilient facing plate, resilient diaphragm, and replaceable bronze seat. Valve includes threaded water and air inlets and water outlet. Loss of air pressure on dry, pilot-line side allows pilot-line actuator to open and causes deluge valve to open immediately.

6. Air-Pressure Maintenance Device:

a. Victaulic Co.

b. Standard: UL 260.

c. Type: Automatic device to maintain minimum air pressure in piping.

d. Include shutoff valves to permit servicing without shutting down sprinkler piping, bypass valve for quick filling, pressure regulator or switch to maintain pressure, strainer, pressure ratings with 14- to 60-psig adjustable range, and 175-psig outlet pressure.

7. Air Compressor:

a. Viking Corp.

b. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

c. Motor Horsepower: Fractional.

1) Power: 120-V ac, 60 Hz, single phase.

d. Sized for application and capable of achieving system supervisory pressure within 30 minutes in accordance with requirements of NFPA 13. Provide ASME air receiver tank as required to meet requirements on larger systems.

e. Include filters, relief valves, coolers, automatic drains, and gauges.

H. Automatic (Ball Drip) Drain Valves:
   1. Tyco Fire Products
   2. Standard: UL 1726.
   3. Pressure Rating: 175-psig minimum.
   4. Type: Automatic draining, ball check.
   5. Size: NPS 3/4.
   6. End Connections: Threaded.

2.6 SPRINKLER PIPING SPECIALTIES

A. General Requirements for Dry-Pipe System Fittings: UL listed for dry-pipe service.

B. Branch Outlet Fittings:
   1. Victaulic Co.
   2. Standard: UL 213.
   3. Pressure Rating: 175-psig minimum.
   4. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
   5. Type: Mechanical-tee and -cross fittings.
   6. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
   7. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
   8. Branch Outlets: Grooved, plain-end pipe, or threaded.

C. Flow Detection and Test Assemblies:
   1. Victaulic Co
   2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
   3. Pressure Rating: 175-psig minimum.
   4. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
   5. Size: Same as connected piping.
   6. Inlet and Outlet: Threaded.

D. Branch Line Testers:
   1. AGF Manuf.
   2. Standard: UL 199.
   3. Pressure Rating: 175-psig minimum.
   4. Body Material: Brass.
   5. Size: Same as connected piping.
   6. Inlet: Threaded.
   7. Drain Outlet: Threaded and capped.
   8. Branch Outlet: Threaded, for sprinkler.

E. Sprinkler Inspector's Test Fittings:
   1. Victaulic Co
   2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
   3. Pressure Rating: 175-psig minimum.
   4. Body Material: Cast- or ductile-iron housing with sight glass.

5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

F. Adjustable Drop Nipples:
1. Aegis Technologies, Inc.
2. Standard: UL 1474.
3. Pressure Rating: 250-psig minimum.
4. Body Material: Steel pipe with EPDM O-ring seals.
5. Size: Same as connected piping.
6. Length: Adjustable.
7. Inlet and Outlet: Threaded.

G. Flexible Sprinkler Hose Fittings:
1. Victaulic Co
2. Standard: UL 1474.
3. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
4. Pressure Rating: 175-psig minimum.
5. Size: Same as connected piping, for sprinkler.

2.7 SPRINKLERS

A. Viking Corp.

B. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

C. Pressure Rating for Residential Sprinklers: 175-psig maximum.

D. Pressure Rating for Automatic Sprinklers: 175-psig minimum.

E. Pressure Rating for High-Pressure Automatic Sprinklers: 250-psig minimum.

F. Automatic Sprinklers with Heat-Responsive Element:
1. Nonresidential Applications: UL 199.
2. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.

G. Sprinkler Finishes: Chrome plated.

H. Special Coatings: Wax.

I. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
1. Ceiling Mounting: Chrome-plated steel, one piece, flat.
2. Sidewall Mounting: Chrome-plated steel, one piece, flat.

J. Sprinkler Guards:
1. Viking Corp.
2. Standard: UL 199.
3. Type: Wire cage with fastening device for attaching to sprinkler.

2.8 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Water-Motor-Operated Alarm:
   1. Globe Fire Sprinkler Corp.
   2. Standard: UL 753.
   3. Type: Mechanically operated, with Pelton wheel.
   4. Alarm Gong: Cast aluminum with red-enamel factory finish.
   5. Size: 10-inch diameter.
   6. Components: Shaft length, bearings, and sleeve to suit wall construction.
   7. Inlet: NPS 3/4.
   8. Outlet: NPS 1 drain connection.

C. Electrically Operated Alarm Notification Appliances:
   1. Potter Electric Signal Company, LLC
   2. Electric Bell:
      a. Standard: UL 464.
      b. Type: Vibrating, metal alarm bell.
      c. Size: 6-inch minimum diameter.
      d. Voltage: 120 V ac, 60 Hz, 1 phase.
      e. Finish: Red-enamel or polyester powder-coat factory finish, suitable for outdoor use with approved and listed weatherproof backbox.
   3. Strobe/Horn:
      a. Standard: UL 464.
      b. Tone: Selectable, steady, Temporal-3 (T-3) in accordance with ISO 8201 and ANSI/ASA S3.41, 2400 Hz, electromechanical, broadband.
      c. Voltage: 120 V ac, 60 Hz.
      d. Effective Intensity: 110 cd.
      e. Finish: Red, suitable for outdoor use with approved and listed weatherproof backbox. White letters on housing identifying device as for "Fire."
      f. Sign, Integrated: Mount between backbox and strobe/horn with text visible on both sides, above and below strobe/horn. Housing to be shaped to cover surface-mounted weatherproof backbox. Sign is to consists of white lettering on red plastic identifying it as a "Sprinkler Fire Alarm" and instructing viewers to call 911, police, or fire department.

D. Pressure Switches - Water-Flow Alarm Detection:
   1. Tyco Fire Products
   2. Standard: UL 346.
   3. Type: Electrically supervised, pressure-activated water-flow switch.
   4. Components: Two single-pole, double-throw switches.
   5. Design Operation: Rising pressure to 6 psi, plus or minus 2 psi signals water flow.
   6. Adjustability: Each switch is to be independently adjustable.
   7. Wire Separation: Pressure switch to provide separation of wiring to each switch connection to allow for low and high volume connections to comply with NFPA 70 Article 760 requirements.

E. Pressure Switches - Low/High Air Pressure Supervisory:
   1. Tyco Fire Products
   2. Standard: UL 346.
   3. Type: Electrically supervised pressure supervisory switch.
   4. Components: Two single-pole, double-throw switches.
   5. Design Operation: Detects increase and/or decrease from normal supervisory air pressure.
   6. Adjustability: Each switch is to be independently adjustable.
   7. Wire Separation: Pressure switch shall provide for separation of wiring to each switch connection to allow for low and high voltage connections to comply with NFPA 70 Article 760 requirements.

F. Valve Supervisory Switches:
   1. Potter Electric Signal Co
   2. General Requirements for Valve Supervisory Switches:
      a. Standard: UL 346.
      b. Type: Electrically supervised.
      c. Design: Signals that controlled valve is in other than fully open position.
      d. Wire Terminal Designations: Indicates normal switch position when switch is properly installed on the valve and valve is fully open.
   3. Requirements for OS&Y Valve Supervisory Switches:
      a. Components: One or two single-pole, double-throw switches.
      b. NEMA Rating: NEMA 4 and NEMA 6P enclosures suitable for mounting in any position indoors or outdoors.
      c. Visual Switch Indication: Indicates device is properly installed and OS&Y valve is fully open.
      d. Mounting Hardware: Mounting bracket to grip valve yoke and prevent movement of switch assembly on OS&Y valve.
      e. Trip Rod Length: Adjustable.
   4. Requirements for PIV and Butterfly Valve Supervisory Switches:
      a. Components: Two single-pole, double-throw switches.
      b. NEMA Rating: NEMA 4 and NEMA 6P enclosures suitable for mounting in any position indoors or outdoors.
      c. Mounting Hardware: Removable nipple.
      d. Trip Rod Length: Adjustable.
   5. Requirements for Ball Valve Supervisory Switch:
      a. Components: One single-pole, double-throw switch.
      b. NEMA Rating: NEMA 4 enclosure suitable for mounting in any position indoors or outdoors.
      c. Mounting Hardware: Suitable for mounting directly to pipe, ball valves or backflow preventers sized from up to NPS 2.

2.9 MANUAL CONTROL STATIONS

A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide" for hydraulic operation, with union, NPS 1/2 pipe nipple, and bronze ball valve.

B. Include metal enclosure labeled "MANUAL CONTROL STATION" with operating instructions and cover held closed by breakable strut to prevent accidental opening.

2.10 CONTROL PANELS

A. Description: Single-area, two-area, or single-area cross-zoned type control panel as indicated, including NEMA ICS 6, Type 1 enclosure, detector, alarm, and solenoid-valve circuitry for operation of deluge valves.

1. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide" when used with thermal detectors and Class A detector circuit wiring.
2. Electrical characteristics are 120-V ac, 60 Hz, with 24-V dc rechargeable batteries.
3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application

B. Manual Control Stations: Electric operation, metal enclosure, labeled "MANUAL CONTROL STATION," with operating instructions and cover held closed by breakable strut to prevent accidental opening.

C. Manual Control Stations: Hydraulic operation, with union, NPS 1/2 pipe nipple, and bronze ball valve. Include metal enclosure labeled "MANUAL CONTROL STATION," with operating instructions and cover held closed by breakable strut to prevent accidental opening.

D. Panels Components:

1. Power supply.
2. Battery charger.
3. Standby batteries.
4. Field-wiring terminal strip.
5. Electrically supervised solenoid valves and polarized fire-alarm bell.
6. Lamp test facility.
7. Single-pole, double-throw auxiliary alarm contacts.
8. Rectifier.

2.11 PRESSURE GAUGES

A. AGF Manufacturing, Inc.

B. Standard: UL 393.

C. Dial Size: 3-1/2- to 4-1/2-inch diameter.

D. Pressure Gauge Range: 0- to 250-psig minimum.

E. Label: Include "WATER" or "AIR/WATER" label on dial face.

F. Air System Piping Gauge: Include retard feature and "AIR" or "AIR/WATER" label on dial face.

PART 3 - EXECUTION

3.1 PREPARATION

A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.

B. Report test results promptly and in writing.

3.2 SERVICE-ENTRANCE PIPING

A. Connect sprinkler piping to water-service piping for service entrance to building. Comply with requirements in Section 211100 "Facility Fire-Suppression Water-Service Piping" for exterior piping.

B. Install shutoff valve, backflow preventer, pressure gauge, drain, and other accessories indicated at connection to water-service piping. Comply with requirements for backflow preventers in Section 211100 "Facility Fire-Suppression Water-Service Piping."

C. Install shutoff valve, check valve, pressure gauge, and drain at connection to water service.

3.3 WATER-SUPPLY CONNECTIONS

A. Connect sprinkler piping to building's interior water-distribution piping. Comply with requirements for interior piping in Section 221116 "Domestic Water Piping."

B. Install shutoff valve, backflow preventer**,** pressure gauge, drain, and other accessories indicated at connection to water-distribution piping. Comply with requirements in Section 211100 "Facility Fire-Suppression Water-Service Piping" for backflow preventers.

C. Install shutoff valve, check valve, pressure gauge, and drain at connection to water supply.

3.4 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.

2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.

C. Install seismic restraints on piping. Comply with NFPA 13 requirements for seismic-restraint device materials and installation.

D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

E. Install unions adjacent to each valve in pipes NPS 2 and smaller.

F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.

H. Install sprinkler piping with drains for complete system drainage.

I. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.

J. Install automatic (ball drip) drain valves to drain piping between fire department connections and check valves. Drain to floor drain or to outside building.

K. Connect compressed-air supply to dry-pipe sprinkler piping.

L. Connect air compressor to the following piping and wiring:

1. Pressure gauges and controls.

2. Electrical power system.

3. Fire-alarm devices, including low-pressure alarm.

M. Install alarm devices in piping systems.

N. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements in NFPA 13. In seismic-rated areas, refer to Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment."

O. Install pressure gauges on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gauges with connection not less than NPS 1/4 and with soft-metal seated globe valve, arranged for draining pipe between gauge and valve. Install gauges to permit removal, and install where they are not subject to freezing.

P. Drain dry-pipe sprinkler piping.

Q. Pressurize and check dry-pipe sprinkler system piping and air compressors.

R. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

S. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

T. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 210518 "Escutcheons for Fire-Suppression Piping."

3.5 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.

B. Install unions adjacent to each valve in pipes NPS 2 and smaller.

C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.

G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

   1. Apply appropriate tape or thread compound to external pipe threads.

   2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

H. Twist-Locked Joints: Insert plain end of steel pipe into plain-end-pipe fitting. Rotate retainer lugs one-quarter turn or tighten retainer pin.

I. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.

J. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.

K. Copper-Tubing Grooved Joints: Roll rounded-edge groove in end of tube according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join copper tube and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

L. Copper-Tubing, Pressure-Sealed Joints: Join copper tube and copper pressure-seal fittings with tools recommended by fitting manufacturer.

M. Extruded-Tee Connections: Form tee in copper tube according to ASTM F2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.

N. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.6 VALVE AND SPECIALTIES INSTALLATION

A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

D. Specialty Valves:

1. Install valves in vertical position for proper direction of flow, in main supply to system.

2. Install dry-pipe valves with trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gauges, priming chamber attachment, and fill-line attachment.

a. Install air compressor and compressed-air-supply piping.

b. Install air-pressure maintenance device with shutoff valves to permit servicing without shutting down sprinkler system; bypass valve for quick system filling; pressure regulator or switch to maintain system pressure; strainer; pressure ratings with 14- to 60-psig adjustable range; and 175-psig maximum inlet pressure.

c. Install compressed-air-supply piping from building's compressed-air piping system.

3.7 SPRINKLER INSTALLATION

A. Install sprinklers in suspended ceilings in center of narrow dimension of acoustical ceiling panels.

B. Install sprinklers with water supply from heated space. Do not install pendent or sidewall sprinklers in areas subject to freezing.

C. Install sprinklers into flexible, sprinkler hose fittings, and install hose into bracket on ceiling grid.

3.8 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.9 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.

2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.

4. Energize circuits to electrical equipment and devices.

5. Start and run air compressors.

6. Coordinate with fire-alarm tests. Operate as required.

7. Coordinate with fire-pump tests. Operate as required.

8. Verify that equipment hose threads are same as local fire department equipment.

B. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.10 CLEANING

A. Clean dirt and debris from sprinklers.

B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

3.11 DEMONSTRATION

A. Owner's maintenance personnel to adjust, operate, and maintain specialty valves.

3.12 PIPING SCHEDULE

A. Piping between Fire Department Connections and Check Valves: Galvanized, standard-weight steel pipe with threaded ends, cast-iron threaded fittings, and threaded, grooved ends, grooved-end fittings, grooved-end-pipe couplings, and groove**d** joints.

B. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.

C. Copper-tube, extruded-tee connections may be used for tee branches in copper tubing instead of specified copper fittings. Branch-connection joints must be brazed.

D. Standard-pressure, dry-pipe sprinkler system, NPS 2 and smaller, shall be one of the following:

1. Standard-weight, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
2. Standard-weight, galvanized-steel pipe with plain ends; plain-end-pipe fittings; and twist-locked joints.
3. Standard-weight, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
4. Type M, hard copper tube with plain ends; cast- or wrought-copper, solder-joint fittings; and brazed joints.
5. Type M, hard copper tube with plain ends; copper pressure-seal fittings; and pressure-sealed joints.
6. NPS 2, Type M, hard copper tube with roll-grooved ends; copper, grooved-end fittings; grooved-end-tube couplings; and grooved joints.

E. Standard-pressure, dry-pipe sprinkler system, NPS 2-1/2 to NPS 4, shall be one of the following:

1. Standard-weight, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
2. Standard-weight, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
3. Type M, hard copper tube with plain ends; cast- or wrought-copper, solder-joint fittings; and brazed joints.
4. Type M, hard copper tube with plain ends; copper pressure-seal fittings; and pressure-sealed joints.
5. Type M, hard copper tube with roll-grooved ends; copper, grooved-end fittings; grooved-end-tube couplings; and grooved joints.

F. Standard-pressure, dry-pipe sprinkler system, NPS 5 and NPS 6, shall be one of the following:

1. Standard-weight, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
2. Standard-weight, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
3. Type M, hard copper tube with plain ends; cast- or wrought-copper, solder-joint fittings; and brazed joints.
4. Type M, hard copper tube with roll-grooved ends; copper, grooved-end fittings; grooved-end-tube couplings; and grooved joints.

3.13 SPRINKLER SCHEDULE

A. Use sprinkler types in subparagraphs below for the following applications:

1. Rooms without Ceilings: Upright sprinklers.
2. Rooms with Suspended Ceilings: Dry recessed sprinklers.
3. Wall Mounting: Dry sidewall sprinklers.
4. Spaces Subject to Freezing: Upright sprinklers, Dry sidewall sprinklers; and dry sidewall sprinklers as indicated.
5. Special Applications: Extended-coverage and quick-response sprinklers where indicated.

B. Provide sprinkler types in subparagraphs below with finishes indicated.

1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
2. Flush Sprinklers: Bright chrome, with painted white escutcheon.
3. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.
4. Upright, Pendent and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

END OF SECTION

SECTION 220000

GENERAL REQUIREMENTS FOR PLUMBING TRADES

PART 1 - GENERAL

1.1 STIPULATIONS

A. The Specifications Sections “General Conditions of Contract”, “Special Conditions” and “Division 1 – General Requirements” form a part of this Section by this reference thereto, and shall have the same force and effect as if printed herewith in full.

1.2 SINGULAR NUMBER

A. In all cases where a device or part of an equipment is herein referred to in the singular, such reference shall apply to as many such items as are required to complete the installation. Quantity determinations of all materials and equipment shall be the complete responsibility of the Contractor.

1.3 DEFINITIONS

A. The following are definitions of terms and expressions used throughout Division 22 specifications:

1. Client Agency - Rockland Green MRF Facility
2. Professional - Anderson Design Group
3. Provide - Furnish and install.
4. Work - Plant, labor and material.
5. Directed - Directed by the PROFESSIONAL.
6. Indicated - Indicated by the contract documents
7. Concealed - Hidden from sight; includes items in shafts, pipe and duct spaces, and above ceilings.
8. Exposed - Not concealed; work within equipment rooms and exposed to view by the occupant shall be considered exposed.
9. Piping - Includes pipes, fittings, valves, hangers, and accessories comprising a System.
10. Ductwork - Includes ducts, fittings, housings, plenums, dampers, hangers, and accessories comprising a system.
11. BMCS - Building Management and Control System.
12. HVAC - Heating, Ventilating, and Air-conditioning.

1.4 SCOPE OF WORK

A. This Section includes general administrative procedures and requirements for mechanical installations, as well as basic materials and methods of construction for the installation of mechanical systems.

B. The following administrative procedures and requirements are included in this section to expand and supplement the requirements specified in the front end of this specification:

1. Work Included
2. Work Excluded
3. Contract Drawings
4. Coordination Drawings
5. Record Drawings
6. Codes, Permits, Approvals
7. Inspections

8. Materials and Equipment
9. Source of Supply List
10. Submittals/Shop Drawings
11. Contractor's Responsibilities - Submittals
12. Substitution of Materials and Equipment
13. Service Agencies
14. Performance of Equipment
15. Guaranty/Warranty
16. Operating and Maintenance Manuals
17. Charts

C. The following basic materials and methods of construction for the installation of mechanical systems are included in this section:

1. Sleeves
2. Fire stopping
3. Finish Plates
4. Equipment foundations
5. Anchor Bolts
6. Concrete Anchors
7. Vibration Control
8. Accessibility
9. Examination of site
10. Dimension of Existing Structures
11. Lines, Grades, and Measurements
12. Coordination
13. Delivery, Storage, and Handling
14. Protection
15. Excavation and Backfilling
16. Cutting and Patching
17. Equipment installation and connection
18. Firestopping Inspection
19. Roof Work
20. Flashing
21. Rooftop Equipment Supports
22. Painting
23. Pipeline Identification
24. Mounting Mechanical Devices in Suspended Ceilings
25. Electrical Work
26. Coordination of Responsibilities.

1.5 WORK INCLUDED

A. Work under Division 22 of the specifications of the contract shall include all plant, labor, and material required to complete the work as shown on the drawings, hereinafter specified, or both. Work of this contract shall include but not be limited to the items outlined in each of the Division 22 sections herein. Work generally includes:

1. Natural gas piping, valves, hangers, roof supports, etc. connected to new equipment.
2. Internal sanitary drainage and vent systems.
3. Complete water distribution system to all fixtures and equipment.
4. Natural gas-fired water heaters and hot water recirculation pumps.
5. All plumbing fixtures, faucets, valves, etc. as listed.
6. Miscellaneous general construction as noted.
7. Thermal insulation as required.
8. Testing and adjustment of all work installed.

B. These specifications, in conjunction with the working drawings, are intended to provide finished work, and all items called for by either or both shall be considered as part of the job. Any items omitted from the specifications or drawings that are clearly necessary for the completion of the work shall be included in the Contract, unless specifically mentioned otherwise.

1.6 WORK EXCLUDED

A. All work shown or specified shall be included in the Contract unless specifically mentioned herein.

1.7 INTENT OF DRAWINGS

A. Work indicated on the drawings shall be provided by the Contractor generally responsible for the work related to any particular drawing, i.e.:

1. H-# drawings - Mechanical/HVAC Contractor
2. P-# drawings - Plumbing Contractor

B. Work may include items that may relate to other major trades. Specifically, all work indicated on the "P" drawings (Plumbing) shall be provided by the Plumbing Contractor unless specifically indicated to be provided by others. The same principle shall apply to "M" drawings (Mechanical), etc.

1.8 CONTRACT DRAWINGS

A. Drawings that constitute a part of this contract indicate the general arrangement of piping, ductwork, accessories, equipment, and other work. It is the intent of these drawings and specifications to describe a complete and integrated system. It is understood that while the drawings may not show every pipe, valve, damper and detail, all equipment and accessories which are reasonably inferable from the drawings and specifications as being necessary for the completion and proper performance of the work shall be included even though not specifically mentioned. What is called for on either the drawings or in the specifications shall be as binding as if called for on both.

B. It is understood that while the drawings shall be followed as closely as circumstances will permit, the Contractor is held responsible for the proper installation of materials and equipment to the true intent and meaning of plans and specifications. Should it be found that any equipment, piping, ductwork cannot be installed as shown on the drawings, the Contractor shall consult with the Professional before making any changes.

1.9 COORDINATION DRAWINGS

A. The contractor shall prepare coordination drawings for Mechanical equipment rooms, chases, congested areas above ceilings, and other congested areas.

B. Coordination drawings shall be prepared to a scale of 1/4”=1’-0” or larger, detailing major elements, components, and systems of mechanical equipment and materials in relationship to other systems, installations and building components.

C. Coordination drawings shall:

1. Indicate the proposed locations of any piping, ductwork, equipment and materials relating to the following:

   a. Exterior wall and foundation penetrations

   b. Equipment pads and bases

   c. Clearances for installing, servicing and maintaining equipment, including tube removal, filter removal and space for equipment disassembly required for periodic maintenance.

   d. Equipment service connections and support details.

   e. Ceiling plenums, chases, shafts, trenches, and other tight and congested spaces

   f. Duct system layout, include elbows, radii, and accessories.

2. Indicate the proposed scheduling, sequencing, movement and positioning of large equipment into the building during construction.

3. Include floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

4. Include reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communication systems components, sprinklers, and other ceiling-mounted items.

1.10 RECORD DRAWINGS

A. At final inspection, the Contractor shall prepare and deliver to the Professional a complete set of contract prints in PDF format, corrected with suitable markings to show all changes or variations from the original contract showing details of the work as actually built including but not limited to horizontal and vertical dimensions of all concealed pipe and equipment.

1.11 CODES, PERMITS, APPROVALS

A. All required local, state and utility company permits and approvals shall be applied for and paid for by this Contractor.

B. All persons digging at the site shall notify the responsible New York agency to mark all underground utilities prior to digging.

C. All plumbing, fire protection, and mechanical/HVAC work under this contract shall be subject to all provisions of the latest editions - including supplements - of the New York State Building Code, the New York State Plumbing Code, the International Plumbing Code, the International Building Code, and the International Fire Code, including NFPA-90a and 90b. Plumbing system shall comply with all municipal, state, and local codes having jurisdiction.

D. All work shall meet the requirements and standards of the several Utility Company(s) serving the project. Install and test backflow preventers in accordance with regulations of the serving utility company.

E. All heating work, pressure vessels, etc. shall comply with the latest revision of the regulations of the Commonwealth of Pennsylvania, Department of Labor and Industry.

F. All materials furnished shall meet the ASTM Specifications latest revisions.

H. All electrical work shall be in conformance with the latest edition of the National Electrical Code.

I. All sprinkler work shall be subject to all applicable provisions of the International Building Code (latest edition) and the National Fire Code pamphlet NFPA-13.

1.12 INSPECTIONS

A. All plumbing work shall be inspected by a certified Inspection Agency to guarantee conformance to the New York State Building Code and the International Plumbing Code requirements.

B. Upon completion of the plumbing work, this Contractor shall pay for and deliver to the Professional, two (2) copies of the Agency's Certificate of Final Approval. This inspection shall cover only the work performed under this contract.

1.13 MATERIALS AND EQUIPMENT

A. Equipment and materials specified shall, in all cases, be the quality standard for base bidding.

B. See General Conditions.

C. The contractor understands that:

1. the Professional will use their own judgment in determining whether or not any materials, equipment or methods offered for review as an equivalent are equivalent to those specified and will fit the space available;
2. the decision of the Professional on all such questions of equivalency is final;
3. any acceptable material, equipment and methods will be provided at no increases in cost to the Institution.

1.14 SOURCE OF SUPPLY LIST

A. Within 21 days after award of contract, the contractor shall submit to the Professional for review a list of manufacturer's names of material and equipment he proposes to provide. In the event any item of material or equipment contained in the list fails to comply with the specification requirements, such item will be rejected. If, prior to the expiration of the 21-day period, or any duly authorized extension thereof, the Contractor fails to submit a schedule of acceptable material or equipment, the Professional will select the items; such selection shall be final and binding upon the Contractor as condition of the contract. Rejected items shall be resubmitted within 21 days or the Professional will select such materials and equipment.

1.15 SUBMITTALS AND SHOP DRAWINGS

A. After receiving approval of the source of supply list; furnish catalog data, dimensional data, performance specifications, etc., in sufficient detail to properly identify and judge each item. Each item or equipment proposed shall be a standard product of the approved manufacturer.

B. Samples, drawings, specifications, catalogs, etc., submitted for review shall be dated, properly labeled indicating specific service for which material or equipment is to be used, section and article number of specifications governing, Contractor's name, and name of job.

C. Review of shop drawings or samples by the Professional shall not relieve the Contractor of responsibility for any deviation from the requirements of the contract documents. Deviations from the contract documents will be only be allowed if all the following are satisfied:

1. The Contractor has informed the Professional in writing of all deviations at the time of submission,
2. the contractor has noted the deviation on the shop drawings,
3. The Professional has acknowledged, in writing, the specific deviation.

D. In any event, the Professional's review shall not relieve the Contractor from responsibility for errors or omissions in the shop drawings or samples.

E. No materials or equipment shall be purchased, delivered to the site, or installed until they have been reviewed by the Professional. Review of any submittal shall not relieve the Contractor of responsibility for deviation from the drawings or specifications, nor shall it relieve the Contractor from errors in the submittals. Dimensions and quantities shall, in all cases, be the complete responsibility of the Contractor.

F. Subsequent to the Professional's review of a submittal, it shall be marked with one or more comments as defined below:

1. No Exceptions Taken: The contractor may proceed using the reviewed material,
2. Note Markings: The contractor may proceed using the reviewed material provided corrective action is taken on all comments noted on the submittal,
3. Comments Attached: Same as "Note Markings", except that comments have been noted on a supplemental attachment,
4. Contractor Confirm: The contractor shall respond in writing to all comments including confirmation that corrective action will be taken on all comments noted prior to proceeding with the work,
5. Resubmit: The contractor shall respond to all comments noted, revise shop drawings accordingly, and resubmit for review,
6. Rejected: The proposed material or equipment does not comply with the requirements of the contract documents and may not be used for this project.

G. Upon receipt of written notice from the Professional that the material, equipment or methods have been reviewed and marked either "no exceptions taken", "Note Markings", or "Comments Attached", the Contractor may proceed with the reviewed material, equipment or methods. The Contractor assumes full responsibility for and shall make, at no expense to the Institution, all changes or adjustments in construction that may result by the use of such approved materials, equipment or methods, including electrical and other services provided under other divisions of this specification. In the event of any adverse decisions by the Professional, no claim of any sort shall be made or allowed against the Professional or the Institution.

H. If material or equipment is installed prior to receipt by the contractor of submittals marked "no exceptions taken", "note markings", or "comments attached", the Contractor shall be liable for its removal and replacement at no extra cost to the Institution.

I. Sufficient sets shall be submitted to allow two 2 copies to be retained by the Professional.

J. Materials and equipment requiring submittals are listed in each section of these specifications.

K. See also the General Conditions, paragraph 63.42 "Shop Drawings and Samples".

1.16 CONTRACTORS RESPONSIBILITY - SUBMITTALS

A. Each submittal forwarded to the Professional/Professional's office for review shall be accompanied by a letter certifying that the Contractor has personally reviewed the material submitted and found it to be satisfactory for this project. This certification shall cover dimensional checking as well as cross checking with the Architectural, Mechanical and/or Electrical documents to insure that no changes will be required in other contracts.

B. Any material submitted to the Professional's office without this Contractor's certification will be returned without action.

C. Whenever alternate equipment is submitted, it shall be accompanied by a 1/4" - 1'0" scale drawing of the mechanical equipment room showing the alternate equipment, all clearances, etc. Submittals without this information will be returned without review or comment.

1.17 SUBSTITUTION OF EQUIPMENT

A. Substitution of equipment of makes other than those specified, after receipt of the bid, will be approved by the Professional only if:

1. The equipment proposed for substitution is equivalent or superior to equipment named in terms of construction, efficiency, and utility, and
2. That the equipment named in the specifications cannot be delivered to the job in time to complete the work in proper sequence to work of other Contractors, due to conditions beyond control of the Contractor.

B. To receive consideration, requests for substitutions must be accompanied by documentary proof of equivalence or difference in price and delivery, if any, in form of certified quotations from suppliers of both specified and proposed equipment.

C. In case of a difference in price, the Institution shall receive all benefit of the difference in cost involved in any substitution, and the contract altered by change order to credit Institution with any savings so obtained.

1.18 SERVICE AGENCIES

A. All mechanical equipment suppliers shall have an established authorized service agency located within a 50-mile radius of the project area. Within 15 days after award of the contract, submit to the Professional for review along with the list of material and equipment manufacturer's names, a list of prospective service agencies to be used during the guarantee period. In the event any service agency in the list fails to comply with the specification requirements, such service agency will be rejected.

1.19 PERFORMANCE OF EQUIPMENT

A. All materials, equipment and appurtenances of any kind, shown on the drawings, hereinafter specified or required for the completion of the work in accordance with the intent of these specifications, shall be completely satisfactory and acceptable in operation, performance and capacity. No approval either written or verbal of any drawings, descriptive data or samples of such material, equipment and/or appurtenances shall relieve the Mechanical Contractor of his responsibility to turn over the same to the Institution in perfect working order at the completion of the work.

B. If the operation, capacity, or performance of any material, equipment, or appurtenance, does not comply with the drawings and/or specification requirements, or is damaged prior to acceptance by the Institution, respective item(s) will be considered defective. All defective items shall be removed and replaced with proper and acceptable materials, equipment and/or appurtenances, or, put in proper and acceptable working order, satisfactory to the Professional, prior to final payment without additional cost to the Institution.

1.20 GUARANTY/WARRANTY

A. Materials, equipment, and systems furnished under these specifications shall be guaranteed against defects in material, design, and workmanship.

B. The guarantee period shall extend until the later of:

1. A period of one (1) year from the date of final acceptance,
2. Eighteen (18) months from the date of initial start-up.

C. Any material or equipment comprising a part of any system, which shall develop any defect during the guarantee period shall be replaced by the Contractor at their own expense.

D. Contractor shall turn over to the Institution all warranties and guarantees upon completion and final acceptance of project.

1.21 OPERATING AND MAINTENANCE MANUALS

A. Contractor shall submit operating and maintenance instructions for all equipment furnished by them.

B. Maintenance and operating instructions shall be manuals prepared by the various manufacturers for the specific equipment furnished. Manuals shall cover such items as start-up procedures, trouble-shooting, periodic maintenance, etc. Advertising literature or catalogs will not be acceptable in this connection.

C. Three (3) sets of the above material shall be submitted to the Professional for review and approval.

D. Final job acceptance date shall be the date stamped on the operating and maintenance instructions and the guarantee period shall generally extend from that date.

1.22 CHARTS

A. Provide permanent type charts, framed under glass, mounted where directed as follows:

1. Valve charts giving valve use, system and number on tag attached to valve.
2. Equipment and motor list giving system, equipment designation and motor horsepower.
3. Lubrication instructions for all equipment giving type of lubricant and frequency.
4. Service organizations with normal and emergency telephone numbers.
5. Abbreviated operating instructions for all mechanical systems.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Pipes passing through masonry construction shall be fitted with sleeves. Each sleeve shall extend through its respective floor, wall, or partition and shall be cut flush with each surface unless otherwise required. Except where otherwise specified or shown, sleeves shall be two pipe sizes larger than the pipe when uncovered and of sufficient size to allow for the insulation without binding. Sleeves shall be properly installed and securely cemented in place.

B. Sleeves in bearing and masonry walls, floors, and partitions shall be of standard weight steel pipe finished with smooth edges. For other than masonry partitions, through suspended ceiling, and for concealed vertical piping, sleeves shall be No. 22 USS Gauge galvanized iron.

C. Floor sleeves shall extend 1 inch above finished floor in pipe spaces, waterproofed floors, kitchens and toilet rooms. Any additional reinforcing necessary to be used at location of sleeve shall be furnished by the Plumbing Contractor.

D. Where pipes pass through waterproof floor or walls, design of sleeves shall be such that waterproofing can be flashed into and around the sleeves.

E. Where pipes pass through roofs, sleeves will be flashed and made watertight by the General Contractor unless otherwise specified or shown on the drawings. Counter flashing fittings shall be furnished and installed on all vents by this Contractor.

F. Sleeves through exterior walls below grade shall have the space between pipes and sleeve caulked watertight with oakum and lead caulked tight; above grade shall be caulked with an approved caulking compound.

2.2 FIRE STOPPING

A. Provide firestopping for all mechanical penetrations through floor slabs, fire-rated walls and partitions, and at each floor level in vertical service shafts used for mechanical services, as specified herein and approved by the Professional.

B. Sealant: Provide ready-to-use silicone penetration seal that will stop passage of fire, smoke, and water through fire-rated wall and floor penetrations. Sealant provided must cure in the presence of atmospheric moisture to produce durable and flexible seal, and form airtight and watertight bonds with most common building materials in any combination including cement, masonry, steel, and aluminum.

C. UL Classification: Provide firestopping materials that are currently classified with UL as "Fill, Void, or Cavity Materials", and "Through Penetration Firestop Systems".

D. Fire Tests: Provide firestopping materials that have been tested in accordance with ASTM E-814 "Methods for Fire Tests of Through-Penetration Fire Stops" and UL 1479 "Fire Tests of Through-Penetration Firestops".

E. Submittals: Submit manufacturer's technical product data, including product description, technical data, and installation instructions.

F. If sleeves are employed, the average clearance between sleeve and piping shall not exceed one inch (1").

G. Metal Pipe:

1. Support sealant with three-inch (3") thickness of mineral wool, inserted and compressed into opening.
2. Apply sealant bead to depth of one-half inch (1/2") by pushing bead in front of nozzle to fill void above mineral wool support.
3. Tool sealant immediately after application and before skin forms. Protect seal from any disturbance for 48 hours minimum.

H. Plastic (PVC) Pipe:

1. Support sealant with nominal two inch (2") intumescent pipe wrap. Wrap pipe one time less than the pipe size with a minimum of 2 wraps.
2. Apply sealant bead to a depth of one-half inch (1/2") by pushing bead in front of nozzle to fill void above intumescent wrap.
3. Tool sealant immediately after application and before skin forms. Protect seal from any disturbance for 48 hours minimum.

I. Where unusual openings are required because of size, shape of wall or floor construction, the fire stop application and material used shall be referred to the Professional/Professional for review and approval.

J. Pipe insulation shall not pass through sleeves in fire-rated walls and floors. Only fire stopping materials shall be used in these areas.

K. Use Type S, Grade NS, Class 25, Use O, neutral-curing silicone sealant, unless otherwise indicated.

2.3 FINISH PLATES

A. At the end of each pipe sleeve where pipes pass into a finished space or through a suspended ceiling, provide chromium plated finish plates. Wall and ceiling plates shall be preferably one piece, held to the pipe by roundhead set screws or fastened to the building construction.

B. Spring clips on wall and ceiling plates will not be acceptable.

C. Where necessary to cover beads of fittings, special deep escutcheons shall be provided. Where pipe sleeves extend above a finished floor, a floor plate having a deep recess shall be used.

D. Finish plates shall be of cast construction with polished finish.

2.4 ANCHOR BOLTS

A. Provide and set in place, at the time of pouring concrete foundations, all necessary concrete anchors as required for the equipment called for under these specifications.

B. Anchor bolts shall be hook-type, of proper size and length to suit the equipment. Anchor bolts shall be set in pipe sleeves of approximately twice the bolt diameter and one-half the embedded length of the bolt.

C. Plumbing Contractor shall have full responsibility for proper placement of the bolts/anchors and must have a representative present at the time foundations are poured.

D. After the equipment is set in its proper position, the half sleeves and the space between the base of the equipment and the foundation shall be completely filled with a thin cement grout.

2.5 CONCRETE ANCHORS

A. Concrete anchors shall be adjustable type consisting of a cast malleable iron body, hook type anchor bolt, and removable mounting stud. Mounting stud shall be adjustable to compensate for inaccuracies in setting.

2.6 VIBRATION CONTROL

A. Vibration isolation devices shall be provided in accordance with Chapter 46, Table 45, “Selection Guide for Vibration Isolation”, of the American Society of Heating, Refrigerating, and Air-conditioning Engineers, Inc.’s (ASHRAE) 1999 Application Handbook.

2.7 ACCESSIBILITY

A. Locate all equipment that must be serviced, operated, or maintained, in fully accessible positions. Equipment shall include, but not be limited to, VAV terminal units, coils, valves, motors, controllers, dampers, drain points, traps, strainers, etc. The contractor shall rework, at their expense, any equipment that is deemed inaccessible to the satisfaction of the Professional.

B. Where required or directed by the Professional, provide access panels for access to all equipment where no other means of access is available. All access panels shall be of sufficient size to service and remove the equipment for which they are provided, and in no case shall they have a clear opening less than 8" x 8". Access panels shall be set flush with finished surface and shall be held securely in place by means of integral anchoring lugs.

C. In finished walls they shall be smooth, polished nickel bronze access covers and full 8" x 8" openings.

D. Those in floors shall be square nickel bronze non-slip scoriated access covers as conditions require.

E. Access panels in fire rated walls, floors, shafts and partitions shall be labeled as such and shall match the rating of the adjacent construction.

F. Access panels in kitchen areas and toilet rooms shall be stainless steel or have chrome plated finish.

G. Access panels larger than 12" x 12" shall be of steel construction, having frames designed to suit the various locations and materials to which they are attached. The frames shall be rabbeted to receive cover and set flush with finished wall or ceiling surface. Covers shall be of rustproof furniture steel of not less than #14 gauge, and shall be secured with suitable clips and locking cams or countersunk screws. Covers shall be flush with the frames and finished wall or ceiling surface.

H. Where accessible or removable ceilings are provided, ceiling panels or tiles may be removed to serve as access panels.

I. In general, access panels will not be indicated on the drawings. It shall be the Contractor's responsibility to anticipate these needs and to provide access panels as previously specified.

PART 3 - EXECUTION

3.1 EXAMINATION OF SITE

A. Contractor shall familiarize themselves with all drawings and documents for the entire project.

B. By virtue of submitting a proposal, Contractor accepts the fact that tight conditions will likely occur at various locations. No extras will be approved for necessary variations and/or adjustments that may be required to resolve interferences.

C. Details of proposed changes found necessary by field conditions or other causes shall be submitted to the Professional for approval before proceeding with any such change.

D. No extra compensation will be allowed due to a difference between actual dimensions and measurements at the site and those indicated on the drawings.

3.3 LINES, GRADES, AND MEASUREMENTS

A. Make all measurements and check all dimensions necessary for the proper construction of the work called for by the drawings and specifications. During the prosecution of the work, make all necessary measurements to prevent misfitting in said work, and for the accurate construction of the entire work.

3.4 COORDINATION

A. Plumbing Contractor shall plan all phases of their portion of the project so that the work proceeds with a minimum of interference with other trades. They shall cooperate with all other Contractors in coordinating the location of piping, ducts, etc., with lighting fixtures, structural members, etc.

B. Plumbing Contractor shall check all project drawings prior to installing any equipment, pipes, ducts, etc. Any conflicts that become apparent as a result of cross checking drawings shall be resolved with the Professional prior to any work being done. Minor adjustments in location, size, and type of materials necessary to work out any interference shall be made at no extra cost. Being installed "first" in any particular situation will not be considered a factor in the proper resolution of a conflict.

3.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification; adequately packaged and protected to prevent damage during shipment, storage, and handing.

B. Store equipment and materials at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage.

C. If any materials or equipment are found to be damaged or in poor condition at the time installation, the Professional may, at their discretion, order the Contractor to furnish and install new materials or equipment at no additional expense to the Institution.

3.6 PROTECTION

A. All work, equipment and materials shall be protected at all times. All pipe openings shall be capped and plugged during installation.

B. The Contractor shall adequately cover and protect all plumbing fixtures as may be necessary until completion of the work. The Contractor shall be responsible for damage or breakage to fixtures and shall make good such damaged items at no cost to the Department.

C. All exposed polished metal fittings, parts, and devices shall have a protective coating applied and maintained during the course of construction.

D. Protective coverings and coatings shall be maintained and replaced when so directed by the Department until the work is ready for acceptance.

3.7 EXCAVATING, BACKFILLING

A. The Plumbing Contractor shall do all excavating, backfilling and concrete work in connection with the work of his contract. Excavate to grade so that the work being installed will rest on solid beds of undisturbed earth. Backfilling shall be done with clean, compactible earth placed in six-inch (6") layers, tamped firm. Remove all obstructions of any kind that may be encountered. Do all cutting and replacing of pavements and other top surfaces as required and secure necessary approvals before proceeding. Remove all surplus excavated materials and dispose of as directed. No work shall be laid on ground of insufficient bearing quality or unstable condition unless provided with approved means of support. All excess earth and rock from excavating shall be deposited where directed.

B. Where rock or demolition debris is encountered, Excavate the trench to a depth six inches (6") below pipe invert. Place a good compactible fill over the rock to provide a cushion for the pipe.

C. Where earth is of such character as to be unstable, provide shoring and sheet piling as may be necessary to support the banks and prevent movement of earth into excavation. Provide and operate pumping equipment where necessary to keep trenches clear of water.

D. Unless otherwise noted on the drawings or specified hereinafter, concrete shall be 2500 psi of a 1:2:4 mixture of domestic Portland cement, clean sharp sand and suitable crushed stone passing a commercial three-fourth (3/4) inch screen. Total water content of the mix shall not exceed seven (7) gallons per sack of cement.

E. Backfilling by Mechanical trades shall comply with General Construction backfilling requirements if so given.

3.8 CUTTING AND PATCHING

A. Plumbing Contractor shall do all cutting and patching necessary to properly install their materials, except as noted hereafter. This shall include cutting of existing concrete floors and walls. Cutting and patching of every nature required in connection with this Contract shall be done with mechanics experienced in their respective lines of work. All patching shall match adjacent finishes.

B. All cutting in the building shall be done with great care so as not to leave an unsightly surface that may not be concealed by plates, escutcheons, or other normal concealing construction. If such unsightly conditions occur through fault of the Contractor, they shall be required to correct such deficiencies to the satisfaction of the Professional.

C. All holes for piping shall be core drilled through existing concrete floors and walls.

D. No cutting of structural members shall be done until approval has been received from the Professional.

E. Plumbing Contractor shall provide the General Contractor or any other Contractors, which may be affected by his work, locations and sizes of chases, sleeves, and openings required for installation of pipes, ducts, and other equipment. This information shall be presented to the General Contractor previous to pouring concrete, or erecting walls to avoid unnecessary cutting and patching.

F. If openings are omitted or are incorrect through failure of the contractors to follow these instructions, the respective Contractors shall, at their own expense, engage the trade which originally installed the work, to cut and patch to the satisfaction of the Professional/Professional.

3.9 EQUIPMENT INSTALLATION AND CONNECTIONS

A. All equipment shall be installed and connected in accordance with the best engineering practice and in accordance with manufacturer's instructions and recommendations. Auxiliary piping, valves, and electric connections recommended by the manufacturer or required for proper operation shall be provided.

B. Any conflicts between the installation instructions indicated on the contract documents and the manufacturer's instructions and recommendations shall be brought to the attention of the Professional for resolution. The Professional's decision as to the final equipment installation and connections is final and any modifications necessary to obtain such an installation shall be made at no expense to the Institution.

3.10 FIRESTOPPING - INSPECTION

A. Do not cover any firestopping installation that will become concealed behind other construction until each has been inspected by the Institution's representative, the Construction Manager, and any authorities that may have jurisdiction. Any discrepancies in firestopping shall be corrected prior to further construction.

3.11 ROOF WORK

A. Contractor shall engage an authorized roofing contractor to provide all work required on any existing roofs. Installation of equipment supports, fan curbs, and piping penetrations shall not invalidate warranty of the existing roof.

B. Contractor shall submit a letter from the roof manufacturer at the conclusion of the project stating that work performed has not invalidated the existing roof warranty.

3.12 FLASHING

A. Openings for pipes and ductwork through waterproofed floors and roof areas shall be flashed. Vent pipes shall be flashed with 4-lb. Sheet lead, 24 inches square. Flashing shall be extended up around vents, which shall terminate not less than 18 inches above roof, and shall be fastened under vent caps.

3.13 PAINTING

A. Clean and prepare all exposed mechanical work for painting. Painting, except for touch-up work as specified hereafter, is covered under Section 09, "Painting".

B. Upon completion of the job all equipment furnished with a factory finish shall be touched up or repainted by this Contractor as required to remove all scratches, nicks, rust, etc.

3.14 PIPE LINE IDENTIFICATION

A. Interior pipes shall be painted the same color as the adjacent surface. All piping, interior and exterior, shall be marked with an applicable color band upon which is stenciled or written the legend indicating the contents of the pipe. These bands shall be applied at valves and couplings and wherever pipes pass through walls; partitions are excepted. Pipes, not on walls, shall be painted the same color as equipment to which they are joined or they shall be painted with an aluminum paint.

B. Following standards shall be referred to as applicable:

1. American Standards Association, Bulletin A-13-1947- for Identification of Piping.
2. Safe Practices, Pamphlet #88 of the National Safety Council, Incorporated Identification of Piping Systems.

3.15 MOUNTING MECHANICAL DEVICES IN SUSPENDED CEILINGS

A. Support light troffers, air diffusers, grilles, etc. by supplementary hangers located within 6" of each corner. If the weight of the components causes the total dead load to exceed deflection capability of the main runners or cross runners, the components shall be supported independently of the suspension system by the installer of the components placed in ceiling.

END OF SECTION

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SECTION 220519
METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Bimetallic-actuated thermometers.
2. Liquid-in-glass thermometers.
3. Thermowells.
4. Dial-type pressure gages.
5. Gage attachments.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of meter and gage.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 BIMETALLIC-ACTUATED THERMOMETERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ashcroft Inc.
2. Trerice, H. O. Co.
3. Weiss Instruments, Inc.

B. Standard: ASME B40.200.

C. Case: Liquid-filled and sealed type(s); stainless steel with 3-inch nominal diameter.

D. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F.

E. Connector Type(s): Union joint, adjustable angle, with unified-inch screw threads.

F. Connector Size: 1/2 inch, with ASME B1.1 screw threads.

G. Stem: 0.25 or 0.375 inch in diameter; stainless steel.

H. Window: Plain glass.

I. Ring: Stainless steel.

J. Element: Bimetal coil.

K. Pointer: Dark-colored metal.

L. Accuracy: Plus or minus 1 percent of scale range.

2.2 LIQUID-IN-GLASS THERMOMETERS

A. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Tel-Tru Manufacturing Company.
   b. Trerice, H. O. Co.
   c. Weiss Instruments, Inc.
2. Standard: ASME B40.200.
3. Case: Cast aluminum; 7-inch nominal size unless otherwise indicated.
4. Case Form: Adjustable angle unless otherwise indicated.
5. Tube: Glass with magnifying lens and blue or red organic liquid.
6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
7. Window: Glass .
8. Stem: Aluminum and of length to suit installation.
   a. Design for Thermowell Installation: Bare stem.
9. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.3 THERMOWELLS

A. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: CNR or CUNI.
4. Material for Use with Steel Piping: CRES or CSA.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length required to match thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.
11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.4 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Ashcroft Inc.
   b. Trerice, H. O. Co.
   c. Weiss Instruments, Inc.

2. Standard: ASME B40.100.
3. Case: Liquid-filled type(s); cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
8. Pointer: Dark-colored metal.
9. Window: Glass or plastic.
10. Ring: Stainless steel.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.5 GAGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.

B. Valves: Brass or stainless-steel needle, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install thermowells with socket extending one-third of pipe diameter and in vertical position in piping tees.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

C. Install thermowells with extension on insulated piping.

D. Fill thermowells with heat-transfer medium.

E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

F. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.

G. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

H. Install remote-mounted pressure gages on panel.

I. Install valve and snubber in piping for each pressure gage for fluids.

J. Install thermometers in the following locations:
1. Inlet and outlet of each water heater.
2. Inlets and outlets of each domestic water heat exchanger.
3. Inlet and outlet of each domestic hot-water storage tank.
4. Inlet and outlet of each remote domestic water chiller.

K. Install pressure gages in the following locations:
1. Building water service entrance into building.
2. Inlet and outlet of each pressure-reducing valve.
3. Suction and discharge of each domestic water pump.

L. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

M. Adjust faces of meters and gages to proper angle for best visibility.

3.2 THERMOMETER SCHEDULE

A. Thermometers at inlet and outlet of each domestic water heater shall be one of the following:

1. Liquid-filled, bimetallic-actuated type.
2. Metal case, industrial-style, liquid-in-glass type.

B. Thermometer stems shall be of length to match thermowell insertion length.

3.3 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Domestic Cold-Water Piping: 0 to 100 deg F.

B. Scale Range for Domestic Hot-Water Piping: 0 to 250 deg F.

3.4 PRESSURE-GAGE SCHEDULE

A. Pressure gages at discharge of each water service into building shall be one of the following:

1. Liquid-filled, direct-mounted, metal case.
2. Sealed, direct-mounted, plastic case.

B. Pressure gages at suction and discharge of each domestic water pump shall be one of the following:

1. Liquid-filled, direct-mounted, metal case.
2. Sealed, direct-mounted, plastic case.
3. Test plug with EPDM self-sealing rubber inserts.

3.5 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Domestic Water Piping: 0 to 160 psi.

END OF SECTION

SECTION 220523.12
BALL VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Brass ball valves.
2. Bronze ball valves.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1. Certification that products comply with NSF 61 Annex G and NSF 372.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded end valves.
2. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
3. ASME B16.18 for solder-joint connections.
4. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 Annex G and NSF 372 for valve materials for potable-water service.

D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. Valves in Insulated Piping:

1. Include 2-inch stem extensions.
2. Extended operating handles of nonthermal-conductive material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
3. Memory stops that are fully adjustable after insulation is applied.

2.2 BRASS BALL VALVES

A. Brass Ball Valves, Two-Piece with Full Port and Brass Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Apollo Flow Controls; Conbraco Industries, Inc.
   b. Milwaukee Valve Company.
   c. NIBCO INC.
2. Description:
   a. Standard: MSS SP-110.
   b. CWP Rating: 600 psig.
   c. Body Design: Two piece.

d. Body Material: Forged brass.

e. Ends: Threaded and soldered.

f. Seats: PTFE.

g. Stem: Brass.

h. Ball: Chrome-plated brass.

i. Port: Full.

2.3 BRONZE BALL VALVES

A. Bronze Ball Valves, One-Piece:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Apollo Flow Controls; Conbraco Industries, Inc.

   b. FNW; Ferguson Enterprises, Inc.

   c. NIBCO INC.

2. Description:

   a. Standard: MSS SP-110.

   b. CWP Rating: 400 psig.

   c. Body Design: One piece.

   d. Body Material: Bronze.

   e. Ends: Threaded.

   f. Seats: PTFE.

   g. Stem: Bronze.

   h. Ball: Chrome-plated brass.

   i. Port: Reduced.

B. Bronze Ball Valves, Two-Piece with Full Port, and Bronze or Brass Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Apollo Flow Controls; Conbraco Industries, Inc.

   b. Milwaukee Valve Company.

   c. NIBCO INC.

2. Description:

   a. Standard: MSS SP-110.

   b. CWP Rating: 600 psig.

   c. Body Design: Two piece.

   d. Body Material: Bronze.

   e. Ends: Threaded and soldered.

   f. Seats: PTFE.

   g. Stem: Bronze or brass.

   h. Ball: Chrome-plated brass.

   i. Port: Full.

PART 3 - EXECUTION

3.1 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.

3.2 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

B. Select valves 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.

3.3 LOW-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (150 PSIG OR LESS)

A. Pipe NPS 2 and Smaller:

1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
2. Brass ball valves, one piece.
3. Bronze ball valve, one piece with bronze trim.
4. Brass ball valves, two-piece with full port and brass trim.
5. Bronze ball valves, two-piece with full port and bronze or brass trim.

3.4 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
2. Brass ball valve, one piece.
3. Bronze ball valve, one piece with bronze trim.
4. Brass ball valves, two-piece with full port and brass trim.
5. Bronze ball valves, two-piece with full port and bronze or brass trim.

END OF SECTION

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SECTION 220523.14
CHECK VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Bronze swing check valves.
2. Iron swing check valves.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1. Certification that products comply with NSF 61 Annex G and NSF 372.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded end valves.
2. ASME B16.1 for flanges on iron valves.
3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
4. ASME B16.18 for solder joint.
5. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 Annex G and NSF 372 for valve materials for potable-water service.

D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE SWING CHECK VALVES

A. Bronze Swing Check Valves with Bronze Disc, Class 125:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Apollo Flow Controls; Conbraco Industries, Inc.
   b. Milwaukee Valve Company.
   c. NIBCO INC.
2. Description:
   a. Standard: MSS SP-80, Type 3.
   b. CWP Rating: 200 psig.
   c. Body Design: Horizontal flow.
   d. Body Material: ASTM B 62, bronze.
   e. Ends: Threaded or soldered. See valve schedule articles.
   f. Disc: Bronze.

B. Bronze Swing Check Valves with Nonmetallic Disc, Class 125:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Apollo Flow Controls; Conbraco Industries, Inc.

   b. Milwaukee Valve Company.

   c. NIBCO INC.

2. Description:

   a. Standard: MSS SP-80, Type 4.

   b. CWP Rating: 200 psig.

   c. Body Design: Horizontal flow.

   d. Body Material: ASTM B 62, bronze.

   e. Ends: Threaded or soldered. See valve schedule articles.

   f. Disc: PTFE.

2.3 IRON SWING CHECK VALVES

A. Iron Swing Check Valves with Metal Seats, Class 125:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Apollo Flow Controls; Conbraco Industries, Inc.

   b. Milwaukee Valve Company.

   c. NIBCO INC.

2. Description:

   a. Standard: MSS SP-71, Type I.

   b. CWP Rating: 200 psig.

   c. Body Design: Clear or full waterway.

   d. Body Material: ASTM A 126, gray iron with bolted bonnet.

   e. Ends: Flanged or threaded. See valve schedule articles.

   f. Trim: Bronze.

   g. Gasket: Asbestos free.

B. Iron Swing Check Valves with Nonmetallic-to-Metal Seats, Class 125:

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. Crane; Crane Energy Flow Solutions.

2. Description:

   a. Standard: MSS SP-71, Type I.

   b. CWP Rating: 200 psig.

   c. Body Design: Clear or full waterway.

   d. Body Material: ASTM A 126, gray iron with bolted bonnet.

   e. Ends: Flanged or threaded. See valve schedule articles.

   f. Trim: Composition.

   g. Seat Ring: Bronze.

   h. Disc Holder: Bronze.

i. Disc: PTFE.

j. Gasket: Asbestos free.

PART 3 - EXECUTION

3.1 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 swing check valves for proper direction of flow in horizontal position with hinge pin level.

3.2 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.

3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Pump-Discharge Check Valves:

a. NPS 2 and Smaller: Bronze swing check valves with bronze or nonmetallic disc.

b. NPS 2-1/2 and Larger for Domestic Water: Iron swing check valves with lever and weight or spring; resilient-seat check valves.

c. NPS 2-1/2 and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.

B. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

C. End Connections:

1. For Copper Tubing, NPS 2 and Smaller: Threaded or soldered.

2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged or threaded.

3. For Copper Tubing, NPS 5 and Larger: Flanged.

4. For Steel Piping, NPS 2 and Smaller: Threaded.

5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged or threaded.

6. For Steel Piping, NPS 5 and Larger: Flanged.

3.4 LOW-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (150 PSIG OR LESS)

A. Pipe NPS 2 and Smaller:

1. Horizontal and Vertical Applications: Bronze swing check valves with bronze disc, Class 150, with soldered or threaded end connections.

3.5 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller: Bronze swing check valves bronze disc, Class 125, with soldered or threaded end connections.

B. Pipe NPS 2-1/2 and Larger:

1. Iron swing check valves with nonmetallic-to-metal seats, Class 125, with threaded or flanged end connections.

END OF SECTION

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SECTION 220529

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal hanger-shield inserts.
4. Fastener systems.
5. Pipe-positioning systems.
6. Equipment supports.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section 220516 "Expansion Fittings and Loops for Plumbing Piping" for pipe guides and anchors.
3. Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment".

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show fabrication and installation details and include calculations.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.4 QUALITY ASSURANCE

A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.

B. Pipe Welding Qualifications: Qualify procedures and operators according to "2015 ASME Boiler and Pressure Vessel Code, Section IX."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design trapeze pipe hangers and equipment supports.

B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

2.2 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized, hot-dip galvanized, or electro-galvanized.
3. Nonmetallic Coatings: Plastic coated or epoxy powder 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.

B. Stainless-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

C. Copper Pipe and Tube Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly, made from structural-carbon-steel shapes, with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.4 THERMAL HANGER-SHIELD INSERTS

A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.

B. Insulation-Insert Material for Hot Piping: Water-repellent-treated, ASTM C 533, Type I calcium silicate with 100-psig ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.

C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.5 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.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Hilti, Inc.
   b. ITW Ramset/Red Head; Illinois Tool Works, Inc.
   c. MKT Fastening, LLC.

B. Mechanical-Expansion Anchors: Insert-wedge-type anchors, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. B-line, an Eaton business.

b. Empire Tool and Manufacturing Co., Inc.

c. Hilti, Inc.

2. Indoor Applications: Zinc-coated or stainless steel.

3. Outdoor Applications: Stainless steel.

2.6 PIPE-POSITIONING SYSTEMS

A. Description: IAPMO PS 42 positioning system composed of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.7 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-carbon-steel shapes.

2.8 MATERIALS

A. Aluminum: ASTM B 221.

B. Carbon Steel: ASTM A 1011/A 1011M.

C. Structural Steel: ASTM A 36/A 36M carbon-steel plates, shapes, and bars; black and galvanized.

D. Stainless Steel: ASTM A 240/A 240M.

E. Grout: ASTM C 1107/C 1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.

2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation, for penetrations through fire-rated walls, ceilings, and assemblies.

B. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

3.2 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size, or install intermediate supports for smaller-diameter pipes as specified for individual pipe hangers.

2. Field fabricate from ASTM A 36/A 36M carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Thermal Hanger-Shield Installation: Install in pipe hanger or shield for insulated piping.

D. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete, after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.

2. Install mechanical-expansion anchors in concrete, after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

E. Pipe-Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.

F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

H. 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.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. 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.

K. Load Distribution: Install hangers and supports, so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

M. Insulated Piping:

1. Attach clamps and spacers to piping.

a. Piping Operating Above Ambient Air Temperature: Clamp may project through insulation.

b. Piping Operating Below Ambient Air Temperature: Use thermal hanger-shield insert with clamp sized to match OD of insert.

c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39 protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

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 or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal Hanger Shields: Install with insulation of 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 bearing surface smooth.

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/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work.

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 1-1/2 inches.

3.6 PAINTING

A. Touchup: Clean field welds and abraded, shop-painted areas. Paint exposed areas immediately after erecting hangers and supports. Use same materials as those used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded, shop-painted areas on miscellaneous metal are specified in Section 099123 "Interior Painting."

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing-repair paint to comply with ASTM A 780/A 780M.

3.7 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-58 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 finishes.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.

F. Use stainless-steel pipe hangers and stainless-steel or corrosion-resistant attachments for hostile environment applications.

G. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.

H. Use padded hangers for piping that is subject to scratching.

I. Use thermal hanger-shield inserts for insulated piping and tubing.

J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction occurs.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction occurs.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction occurs but vertical adjustment is unnecessary.
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 occurs and vertical adjustment is unnecessary.
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, in addition to expansion and contraction, is required.

K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

L. 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 of 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.

M. 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.

N. 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.

O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
   a. Horizontal (MSS Type 54): Mounted horizontally.
   b. Vertical (MSS Type 55): Mounted vertically.
   c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

P. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

Q. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

R. Use pipe-positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION

SECTION 220553

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Brady Corporation.
   b. Brimar Industries, Inc.
   c. LEM Products Inc.
2. Material and Thickness: Brass, 0.032-inch stainless steel, 0.025-inch aluminum, 0.032-inch or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
3. Letter Color: White.
4. Background Color: Black.
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-quarters 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. Plastic Labels for Equipment:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Brady Corporation.
   b. Brimar Industries, Inc.
   c. LEM Products Inc.
2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
3. Letter Color: White.
4. Background Color: Black.
5. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

6. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
7. 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-quarters the size of principal lettering.
8. Fasteners: Stainless-steel rivets or self-tapping screws.
9. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Brady Corporation.
2. LEM Products Inc.
3. Seton Identification Products.

B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.

C. Letter Color: White.

D. Background Color: Red.

E. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

G. 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-quarters the size of principal lettering.

H. Fasteners: Stainless-steel rivets or self-tapping screws.

I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

J. Label Content: Include caution and warning information plus emergency notification instructions.

2.3 PIPE LABELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Brady Corporation.
2. LEM Products Inc.
3. Marking Sevices Inc.

B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.

D. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

E. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.

2. Lettering Size: Size letters according to ASME A13.1 for piping.

PART 3 - EXECUTION

3.1 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.2 PIPE LABEL INSTALLATION

A. Piping Color Coding: Painting of piping is specified in Section 099123 "Interior Painting."

B. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.

2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.

3. Near penetrations and on both sides of 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. Natural Gas Piping:

a. Background: Safety yellow.

b. Letter Colors: Black.

2. Domestic Water Piping

a. Background: Safety green.

b. Letter Colors: White.

3. Sanitary Waste and Storm Drainage Piping:

a. Background Color: Safety black.

b. Letter Color: White.

END OF SECTION

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SECTION 220719
PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following plumbing piping services:

1. Domestic cold and hot-water piping.
2. Domestic recirculating hot-water piping.
3. Sanitary waste piping exposed to freezing conditions.
4. Storm-water piping exposed to freezing conditions.
5. Roof drains and rainwater leaders.
6. Supplies and drains for handicap-accessible lavatories and sinks.

B. Related Sections:

1. Section 220716 "Plumbing Equipment Insulation."

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties, equipment connections, and access panels.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

B. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ICC A117.1.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Aeroflex USA, Inc.

b. Armacell LLC.

G. Mineral-Fiber, Preformed Pipe Insulation:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Johns Manville; a Berkshire Hathaway company.

b. Knauf Insulation.

c. Manson Insulation Inc.

2. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Aeroflex USA, Inc.

b. Armacell LLC.

c. Foster Brand; H. B. Fuller Construction Products.

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Childers Brand; H. B. Fuller Construction Products.

b. Eagle Bridges - Marathon Industries.

c. Foster Brand; H. B. Fuller Construction Products.

D. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Childers Brand; H. B. Fuller Construction Products.

b. Eagle Bridges - Marathon Industries.

c. Foster Brand; H. B. Fuller Construction Products.

E. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Dow Corning Corporation.

b. Johns Manville; a Berkshire Hathaway company.

c. P.I.C. Plastics, Inc.

2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Childers Brand; H. B. Fuller Construction Products.

b. Foster Brand; H. B. Fuller Construction Products.

c. Knauf Insulation.

2. Water-Vapor Permeance: ASTM E 96/E 96M, 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, 58 percent by volume and 70 percent by weight.

5. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Childers Brand; H. B. Fuller Construction Products.

b. Eagle Bridges - Marathon Industries.

c. Foster Brand; H. B. Fuller Construction Products.

d. Knauf Insulation.

e. Mon-Eco Industries, Inc.

2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.

3. Service Temperature Range: Minus 20 to plus 180 deg F.

4. Solids Content: 60 percent by volume and 66 percent by weight.

5. Color: White.

2.4 SEALANTS

A. Joint Sealants for Cellular-Glass Products:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Childers Brand; H. B. Fuller Construction Products.

   b. Eagle Bridges - Marathon Industries.

   c. Foster Brand; H. B. Fuller Construction Products.

   d. Mon-Eco Industries, Inc.

2. Materials shall be compatible with insulation materials, jackets, and substrates.

3. Permanently flexible, elastomeric sealant.

4. Service Temperature Range: Minus 100 to plus 300 deg F.

5. Color: White or gray.

B. FSK and Metal Jacket Flashing Sealants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Childers Brand; H. B. Fuller Construction Products.

   b. Eagle Bridges - Marathon Industries.

   c. Foster Brand; H. B. Fuller Construction Products.

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.

2.5 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.

2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.6 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Johns Manville; a Berkshire Hathaway company.

   b. P.I.C. Plastics, Inc.

   c. Proto Corporation.

2. Adhesive: As recommended by jacket material manufacturer.

3. Color: White.

4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
    a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

C. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Childers Brand; H. B. Fuller Construction Products.
    b. ITW Insulation Systems; Illinois Tool Works, Inc.
2. Factory cut and rolled to size.
3. Finish and thickness are indicated in field-applied jacket schedules.
4. Moisture Barrier for Indoor Applications: 1-mil-thick, heat-bonded polyethylene and kraft paper.
5. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
6. Factory-Fabricated Fitting Covers:
    a. Same material, finish, and thickness as jacket.
    b. Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
    c. Tee covers.
    d. Flange and union covers.
    e. End caps.
    f. Beveled collars.
    g. Valve covers.
    h. Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.7 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Avery Dennison Corporation, Specialty Tapes Division.
    b. Compac Corporation.
    c. Ideal Tape Co., Inc., an American Biltrite Company.
    d. Knauf Insulation.
2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Avery Dennison Corporation, Specialty Tapes Division.

b. Compac Corporation.

c. Ideal Tape Co., Inc., an American Biltrite Company.

d. Knauf Insulation.

2. Width: 3 inches.

3. Thickness: 6.5 mils.

4. Adhesion: 90 ounces force/inch in width.

5. Elongation: 2 percent.

6. Tensile Strength: 40 lbf/inch in width.

7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Compac Corporation.

b. Ideal Tape Co., Inc., an American Biltrite Company.

2. Width: 2 inches.

3. Thickness: 6 mils.

4. Adhesion: 64 ounces force/inch in width.

5. Elongation: 500 percent.

6. Tensile Strength: 18 lbf/inch in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Avery Dennison Corporation, Specialty Tapes Division.

b. Compac Corporation.

c. Ideal Tape Co., Inc., an American Biltrite Company.

d. Knauf Insulation.

2. Width: 2 inches.

3. Thickness: 3.7 mils.

4. Adhesion: 100 ounces force/inch in width.

5. Elongation: 5 percent.

6. Tensile Strength: 34 lbf/inch in width.

2.8 SECUREMENTS

A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.

B. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. ITW Insulation Systems; Illinois Tool Works, Inc.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.

D. Wire: 0.080-inch nickel-copper alloy.

2.9 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers,:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. McGuire Manufacturing.

   b. Plumberex Specialty Products, Inc.

   c. Truebro.

2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

B. Protective Shielding Piping Enclosures,:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

   a. Truebro.

2. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.

2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:
1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
   a. For below-ambient services, apply vapor-barrier mastic over staples.
4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:
1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Cleanouts.

3.3 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.

4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.

2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.4 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.

2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.

3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.

4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.

5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.

6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.5 INSTALLATION OF CELLULAR-GLASS INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 INSTALLATION OF MINERAL-FIBER PREFORMED PIPE INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.8 FIELD-APPLIED JACKET INSTALLATION

A. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

B. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

C. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.9 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.10 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.11 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.

2. Underground piping.

3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.12 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold, Hot and Recirculated Hot Water: Insulation shall be one of the following:

1. Flexible Elastomeric: 3/4 inch thick.

2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

B. Stormwater and Overflow: Insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.

2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

C. Roof Drain and Overflow Drain Bodies: Insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.

2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

3. Polyolefin: 1 inch thick.

D. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities: Insulation shall be one of the following:

1. Flexible Elastomeric: 1/2 inch thick.
2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.

3.13 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

1. None.
2. PVC: 20 mils thick.
3. Aluminum, Corrugated: 0.016 inch thick.

D. Piping, Exposed:

1. None.
2. PVC: 20 mils thick.
3. Aluminum, Corrugated: 0.016 inch thick.

END OF SECTION

SECTION 221116
DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Copper tube and fittings.
2. PEX tube and fittings.
3. Piping joining materials.
4. Transition fittings.
5. Dielectric fittings.

1.2 ACTION SUBMITTALS

A. Product Data: For transition fittings and dielectric fittings.

1.3 INFORMATIONAL SUBMITTALS

A. System purging and disinfecting activities report.

B. Field quality-control reports.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

B. Potable-water piping and components shall comply with NSF 14 and NSF 61 Annex G. Plastic piping components shall be marked with "NSF-pw."

C. Comply with NSF 372 for low lead.

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.

B. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.

C. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

D. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

E. Copper Unions:

1. MSS SP-123.
2. Cast-copper-alloy, hexagonal-stock body.
3. Ball-and-socket, metal-to-metal seating surfaces.
4. Solder-joint or threaded ends.

F. Copper Pressure-Seal-Joint Fittings:

1. Fittings for NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
2. Fittings for NPS 2-1/2 to NPS 4: Cast-bronze or wrought-copper fitting with EPDM-rubber, O-ring seal in each end.

G. Copper Push-on-Joint Fittings:

1. Copper Push-on-Joint Fittings are **<u>not allowed</u>** on this project.

2.3 PEX TUBE AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. REHAU.
2. Uponor.
3. Viega LLC.

B. Tube Material: PEX plastic according to ASTM F 876 and ASTM F 877.

C. Fittings: ASTM F 1960, cold expansion fittings and reinforcing rings.

D. Manifold: Multiple-outlet, plastic or corrosion-resistant-metal assembly complying with ASTM F 876; with plastic or corrosion-resistant-metal valve for each outlet.

2.4 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials:

1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
2. Full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys.

D. Flux: ASTM B 813, water flushable.

E. Brazing Filler Metals: AWS A5.8M/A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

F. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Charlotte Pipe and Foundry Company.
   b. Harvel Plastics, Inc.
   c. Sioux Chief Manufacturing Company, Inc.
   d. Spears Manufacturing Company.
2. Description:
   a. CPVC or PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions.
   b. One end with threaded brass insert and one solvent-cement-socket or threaded end.

D. Plastic-to-Metal Transition Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Colonial Engineering, Inc.

   b. NIBCO INC.

2. Description:

   a. CPVC or PVC four-part union.

   b. Brass or stainless-steel threaded end.

   c. Solvent-cement-joint or threaded plastic end.

   d. Rubber O-ring.

   e. 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Central Plastics Company.

   b. WATTS.

   c. Wilkins.

2. Standard: ASSE 1079.

3. Pressure Rating: 125 psig minimum at 180 deg F.

4. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Central Plastics Company.

   b. WATTS.

   c. Wilkins.

2. Standard: ASSE 1079.

3. Factory-fabricated, bolted, companion-flange assembly.

4. Pressure Rating: 125 psig minimum at 180 deg F.

5. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Advance Products & Systems, Inc.

   b. Calpico, Inc.

   c. Central Plastics Company.

2. Nonconducting materials for field assembly of companion flanges.

3. Pressure Rating: 150 psig.

4. Gasket: Neoprene or phenolic.
5. Bolt Sleeves: Phenolic or polyethylene.
6. Washers: Phenolic with steel backing washers.

E. Dielectric Nipples:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Grinnell Mechanical Products.
b. Matco-Norca.
c. Precision Plumbing Products.
2. Standard: IAPMO PS 66.
3. Electroplated steel nipple complying with ASTM F 1545.
4. Pressure Rating and Temperature: 300 psig at 225 deg F.
5. End Connections: Male threaded or grooved.
6. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.

D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Section 221119 "Domestic Water Piping Specialties."

E. Install shutoff valve immediately upstream of each dielectric fitting.

F. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 221119 "Domestic Water Piping Specialties."

G. Install domestic water piping level without pitch and plumb.

H. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

I. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

J. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

K. 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.

L. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

M. Install piping to permit valve servicing.

N. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

O. Install piping free of sags and bends.

P. Install fittings for changes in direction and branch connections.

Q. Install PEX tubing with loop at each change of direction of more than 90 degrees.

R. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

S. Install pressure gages on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping."

T. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Section 221123 "Domestic Water Pumps."

U. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements for thermometers in Section 220519 "Meters and Gages for Plumbing Piping."

V. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

W. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

X. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

   1. Apply appropriate tape or thread compound to external pipe threads.

   2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.

E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.

G. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

H. Joints for PEX Tubing: Join according to ASTM F 1807 for metal insert and copper crimp ring fittings and ASTM F 1960 for cold expansion fittings and reinforcing rings.

I. Joints for PEX Tubing: Join according to ASSE 1061 for push-fit fittings.

J. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.4 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:

1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
2. Fittings for NPS 2 and Larger: Sleeve-type coupling.

C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

3.5 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings or nipples.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.

3.6 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger, support products, and installation in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Vertical Piping: MSS Type 8 or 42, clamps.
2. Individual, Straight, Horizontal Piping Runs:
   a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
   b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
   c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.

E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
4. NPS 2-1/2: 108 inches with 1/2-inch rod.
5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.

F. Install supports for vertical copper tubing every 10 feet.

G. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 and Smaller: 84 inches with 3/8-inch rod.
2. NPS 1-1/2: 108 inches with 3/8-inch rod.
3. NPS 2: 10 feet with 3/8-inch rod.
4. NPS 2-1/2: 11 feet with 1/2-inch rod.
5. NPS 3 and NPS 3-1/2: 12 feet with 1/2-inch rod.

6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
7. NPS 6: 12 feet with 3/4-inch rod.
8. NPS 8 to NPS 12: 12 feet with 7/8-inch rod.

H. Install supports for vertical steel piping every 15 feet.

I. Install vinyl-coated hangers for PEX tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1 and Smaller: 32 inches with 3/8-inch rod.

J. Install hangers for vertical PEX tubing every 48 inches.

K. Support piping and tubing not listed in this article according to MSS SP-58 and manufacturer's written instructions.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:

1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
3. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
4. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.8 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."

B. Label pressure piping with system operating pressure.

3.9 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Piping Inspections:

a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.

b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.

2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.

d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.

b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.

c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.

d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.

e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.

f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.10 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.

2. Open shutoff valves to fully open position.

3. Open throttling valves to proper setting.

4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.

b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.

6. Remove and clean strainer screens. Close drain valves and replace drain plugs.

7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.

8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.11 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.

2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.

b. Fill and isolate system according to either of the following:

1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.

2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.

d. Repeat procedures if biological examination shows contamination.

e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.12 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

D. Under-building-slab, domestic water, building-service piping, NPS 3 and smaller, shall be the following:

1. Soft copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and brazed joints.

E. Under-building-slab, domestic water piping, NPS 2 and smaller, shall be the following:

1. Soft copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and brazed joints.

F. Aboveground domestic water piping, NPS 2 and smaller, shall be one of the following:

1. Hard copper tube, ASTM B 88, Type L; cast- or wrought-copper, solder-joint fittings; and soldered joints.

2. Hard copper tube, ASTM B 88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.

3. PEX tube, NPS 1 and smaller.

a. Fittings for PEX tube:

1) ASTM F 1807, metal insert and copper crimp rings.

2) ASTM F 1960, cold expansion fittings and reinforcing rings.

b. Minimum size allowed is ¾”.

G. Aboveground domestic water piping, NPS 2-1/2 to NPS 4, shall be the following:

1. Hard copper tube, ASTM B 88, Type L; cast- or wrought-copper, solder-joint fittings; and soldered joints.

2. Hard copper tube, ASTM B 88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.

END OF SECTION

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SECTION 221119
DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Vacuum breakers.
2. Backflow preventers.
3. Water pressure-reducing valves.
4. Automatic water shutoff valve systems.
5. Balancing valves.
6. Temperature-actuated, water mixing valves.
7. Strainers for domestic water piping.
8. Outlet boxes.
9. Hose stations.
10. Hose bibbs.
11. Wall hydrants.
12. Ground hydrants.
13. Post hydrants.
14. Roof hydrants.
15. Drain valves.
16. Water-hammer arresters.
17. Trap-seal primer device.
18. Trap-seal primer systems.
19. Flexible connectors.
20. Water meters.

B. Related Requirements:

1. Section 211100 "Facility Fire-Suppression Water-Service Piping" for fire water-service backflow prevention devices.
2. Section 220519 "Meters and Gauges for Plumbing Piping" for thermometers, pressure gauges, and flow meters in domestic water piping.
3. Section 221116 "Domestic Water Piping" for water meters.
4. Section 224716 "Pressure Water Coolers" for water filters for water coolers.

1.3 DEFINITIONS

A. AMI: Advanced Metering Infrastructure.

B. AMR: Automatic Meter Reading.

C. FKM: A family of fluroelastomer materials defined by ASTM D1418.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For domestic water piping specialties.

1. Include diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Test and inspection reports.

B. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Domestic water piping specialties intended to convey or dispense water for human consumption are to comply with the SDWA, requirements of authorities having jurisdiction, and NSF 61 and NSF 372, or to be certified in compliance with NSF 61 and NSF 372 by an American National Standards Institute (ANSI)-accredited third-party certification body that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

2.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 20 PSIG unless otherwise indicated.

2.3 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:

1. Apollo
2. Standard: ASSE 1001.
3. Size: NPS 1/4 to NPS 3, as required to match connected piping.
4. Body: Bronze.
5. Inlet and Outlet Connections: Threaded.
6. Finish: Rough bronze.

B. Hose-Connection Vacuum Breakers FPHB-1:

1. Woodford Manufacturing
2. Standard: ASSE 1011.
3. Body: Bronze, nonremovable, with manual drain.
4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
5. Finish: Chrome or nickel plated.

C. Pressure Vacuum Breakers:

1. Apollo
2. Standard: ASSE 1020.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 5 PSIG > maximum, through middle third of flow range.
5. Size: 3/4**”**.
6. Design Flow Rate: 45 GPM.
7. Selected Unit Flow Range Limits: 45 GPM.
8. Pressure Loss at Design Flow Rate: 3 PSIG.

9. Accessories:
    a. Valves: Ball type, on inlet and outlet.

2.4 BALANCING VALVES

A. Copper-Alloy Calibrated Balancing Valves CS:
1. Watts
2. Type: Ball valve with two readout ports and memory-setting indicator.
3. Body: Bronze.
4. Size: Same as connected piping, but not larger than NPS 2.
5. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

B. Memory-Stop Balancing Valves CS:
1. Apollo
2. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
3. Pressure Rating: 400-psig minimum CWP.
4. Size: NPS 2 or smaller.
5. Body: Copper alloy.
6. Port: Standard or full port.
7. Ball: Chrome-plated brass or stainless steel.
8. Seats and Seals: Replaceable.
9. End Connections: Solder joint or threaded.
10. Handle: Vinyl-covered steel with memory-setting device.

C. Automatic Flow Control Balancing Valves CS:
1. Caleffi North America
2. Flow Regulation: Plus or minus 5 percent over 95 percent of the working range.
3. Pressure Rating: 200 psig.
4. Size: NPS 2 or smaller.
5. Body: Stainless steel or brass.
6. Flow Cartridge: Stainless steel or antiscale polymer.
7. End Connections: Threaded or solder joint.

2.5 TEMPERATURE-ACTUATED, WATER MIXING VALVES

A. Water-Temperature Limiting Devices TMV:
1. Apollo
2. Standard: ASSE 1070.
3. Pressure Rating: 125 psig.
4. Type: Thermostatically controlled, water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Threaded union inlets and outlet.
7. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
8. Tempered-Water Setting: 110°F (adjustable).
9. Tempered-Water Design Flow Rate: 0.5 gpm.
10. Valve Finish: Chrome plated.

B. Primary, Thermostatic, Water Mixing Valves TMV:

1. Leonard Valve Company
2. Standard: ASSE 1017.
3. Pressure Rating: 125 psig minimum unless otherwise indicated.
4. Type: Exposed-mounted, thermostatically controlled, water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Threaded inlets and outlet.
7. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
8. Tempered-Water Setting: 110°F (adjustable).
9. Tempered-Water Design Flow Rate: 13.5 gpm.
10. Selected Valve Flow Rate at 45-psig Pressure Drop: 210 gpm.
11. Pressure Drop at Design Flow Rate: 1.0 psig.
12. Valve Finish: Chrome plated.
13. Piping Finish: Copper.
14. Cabinet: Factory fabricated, stainless steel, for surface mounting and with hinged, stainless steel door.

C. Individual-Fixture, Water Tempering Valves TMV:

1. Acorn Engineering Company
2. Standard: ASSE 1016, thermostatically controlled, water tempering valve.
3. Pressure Rating: 125 psig minimum unless otherwise indicated.
4. Material: Bronze body with corrosion-resistant interior components.
5. Temperature Control: Adjustable.
6. Connections: Threaded inlets and outlet.
7. Finish: Chrome plated.
8. Tempered-Water Setting: 110°F (adjustable).
9. Tempered-Water Design Flow Rate: 0.5 GPM.

D. Primary Water Tempering Valves TMV:

1. Watts
2. Standard: ASSE 1017, thermostatically controlled, water tempering valve, listed as tempering valve.
3. Pressure Rating: 125 psig minimum unless otherwise indicated.
4. Material: Bronze body.
5. Temperature Control: Manual.
6. Connections: Threaded inlets and outlet.
7. Selected Primary Water Tempering Valve Size: 1½”.
8. Tempered-Water Setting: 110°F (adjustable).
9. Tempered-Water Design Flow Rate: 13.5 gpm.
10. Pressure Drop at Design Flow Rate: 1.0 psig.
11. Tempered-Water Outlet Size: 1½” NPS end connection.
12. Cold-Water Inlet Size: 1½” NPS end connection.
13. Hot-Water Inlet Size: 1½” NPS end connection.

14. Valve Finish: Rough bronze.

2.6 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Watts
2. Pressure Rating: 125 psig minimum unless otherwise indicated.
3. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved, epoxy coated and for NPS 2-1/2 and larger.
4. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
5. Screen: Stainless steel with round perforations unless otherwise indicated.
6. Perforation Size:
   a. Strainers NPS 2 and Smaller: 0.020 inch.
   b. Strainers NPS 2-1/2 to NPS 4: 0.045 inch.
   c. Strainers NPS 5 and Larger: 0.10 inch.
7. Drain: Pipe plug.

2.7 OUTLET BOXES

A. Icemaker Outlet Boxes ICE:

1. Guy Gray, IPS Corporation
2. Mounting: Recessed.
3. Material and Finish: Stainless steel box and faceplate.
4. Faucet: Valved fitting complying with ASME A112.18.1. Include NPS 1/2 or smaller copper tube outlet.
5. Accessory: Water hammer arrestor.
6. Supply Shutoff Fitting: NPS 1/2 gate, globe, or ball valve and NPS 1/2 copper, water tubing.

2.8 HOSE BIBBS

A. Hose Bibbs HB-1:

1. Woodford Manufacturing
2. Standard: ASME A112.18.1 for sediment faucets.
3. Body Material: Bronze.
4. Seat: Bronze, replaceable.
5. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
6. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
7. Pressure Rating: 125 psig.
8. Vacuum Breaker: Integral nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
9. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
10. Finish for Service Areas: Chrome or nickel plated.
11. Finish for Finished Rooms: Chrome or nickel plated.
12. Operation for Equipment Rooms: Wheel handle or operating key.
13. Operation for Service Areas: Wheel handle.
14. Operation for Finished Rooms: Wheel handle.
15. Include operating key with each operating-key hose bibb.

16. Include wall flange with each chrome- or nickel-plated hose bibb.

2.9 WALL HYDRANTS

A. Freeze Proof Hose Bibbs FPHB-1:

1. Wall hydrants without integral vacuum breakers or backflow preventers are available but not recommended. Wall hydrants are not generally considered devices to convey or dispense water for human consumption; therefore, some manufacturers do not comply with lead-free construction/certification. If Project application requires lead-free construction, confirm availability of product with manufacturers. Insert drawing designation. Use these designations on Drawings to identify each product.

B. Nonfreeze Vacuum Breaker Wall Hydrants FPHB-1:

1. Woodford Manufacturing.
2. Standard: ASSE 1019, Type A or Type B.
3. Type: Automatic draining with integral air-inlet valve.
4. Classification: Type B, for automatic draining with hose removed or with hose attached and nozzle closed.
5. Pressure Rating: 125 psig.
6. Operation: Loose key.
7. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
8. Inlet: NPS 1/2 or NPS 3/4.
9. Outlet: Exposed with garden-hose thread complying with ASME B1.20.7.

2.10 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 3/4.
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

B. Gate-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-80 for gate valves.
2. Pressure Rating: Class 125.
3. Size: NPS 3/4.
4. Body: ASTM B62 bronze.
5. Inlet: NPS 3/4 threaded or solder joint.
6. Outlet: Garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

C. Stop-and-Waste Drain Valves:

1. Standard: MSS SP-110 for ball valves or MSS SP-80 for gate valves.
2. Pressure Rating: 200-psig minimum CWP or Class 125.
3. Size: NPS 3/4.

4. Body: Copper alloy or ASTM B62 bronze.
5. Drain: NPS 1/8 side outlet with cap.

2.11 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters:
1. Mifab
2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Piston.
4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.12 TRAP-SEAL PRIMER DEVICE

A. Supply-Type, Trap-Seal Primer Device:
1. Watts
2. Standard: ASSE 1018.
3. Pressure Rating: 125 psig minimum.
4. Body: Bronze.
5. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
6. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

B. Drainage-Type, Trap-Seal Primer Device:
1. Mifab, Inc.
2. Standard: ASSE 1044, lavatory P-trap with NPS 3/8 minimum, trap makeup connection.
3. Size: NPS 1-1/4 minimum.
4. Material: Chrome-plated, cast brass.

2.13 FLEXIBLE CONNECTORS

A. Flex Hose Co. Inc.

B. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
1. Working-Pressure Rating: Minimum 200 psig.
2. End Connections NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.
3. End Connections NPS 2-1/2 and Larger: Flanged copper alloy.

C. Stainless Steel-Hose Flexible Connectors: Corrugated-stainless steel tubing with stainless steel wire-braid covering and ends welded to inner tubing.
1. Working-Pressure Rating: Minimum 200 psig.
2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.
3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPING SPECIALTIES

A. Backflow Preventers: Install in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
1. Locate backflow preventers in same room as connected equipment or system.

2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
3. Do not install bypass piping around backflow preventers.

B. Water Regulators: Install with inlet and outlet shutoff valves and bypass with memory-stop balancing valve. Install pressure gauges on inlet and outlet.

C. Water Control Valves: Install with inlet and outlet shutoff valves and bypass with globe valve. Install pressure gauges on inlet and outlet.

D. Automatic Water Shutoff Valves: Test for signal strength before valve installation. Install automatic shutoff valve downstream from main domestic water shutoff valve. Install valve controller in an accessible location with sensors in areas where water is likely to accumulate.

E. Balancing Valves: Install in locations where they can easily be adjusted. Set at indicated design flow rates.

F. Temperature-Actuated, Water Mixing Valves: Install with check stops or shutoff valves on inlets and with shutoff valve on outlet.

1. Install cabinet-type units recessed in or surface mounted on wall as specified.

G. Y-Pattern Strainers: For water, install on supply side of each control valve, water pressure-reducing valve, solenoid valve and pump.

H. Outlet Boxes: Install boxes recessed in wall or surface mounted on wall. Install 1-1/2-by-3-1/2-inch fire-retardant-treated-wood blocking, wall reinforcement between studs. Comply with requirements for fire-retardant-treated-wood blocking in Section 061000 "Rough Carpentry."

I. Hose Stations: Install with check stops or shutoff valves on inlets and with thermometer on outlet.

1. Install cabinet-type units recessed in or surface mounted on wall as specified. Install 1-1/2-by-3-1/2-inch fire-retardant-treated-wood blocking, wall reinforcement between studs. Comply with requirements for fire-retardant-treated-wood blocking in Section 061000 "Rough Carpentry."

J. Water-Hammer Arresters: Install in water piping in accordance with PDI-WH 201.

K. Supply-Type, Trap-Seal Primer Device: Install with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

L. Drainage-Type, Trap-Seal Primer Device: Install as lavatory trap with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting.

M. Trap-Seal Primer Systems: Install with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow.

3.2 PIPING CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping specialties adjacent to equipment and machines, allow space for service and maintenance.

3.3 ELECTRICAL CONNECTIONS

A. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."

C. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.

3.4 CONTROL CONNECTIONS

A. Connect control wiring in accordance with Section 260523 "Control-Voltage Electrical Power Cables."

3.5 IDENTIFICATION

A. Plastic Labels for Equipment: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Vacuum breakers.
2. Backflow preventers.
3. Water pressure-reducing valves.
4. Automatic water shutoff valve systems.
5. Balancing valves.
6. Temperature-actuated, water mixing valves.
7. Outlet boxes.
8. Hose stations.
9. Wall hydrants.
10. Trap-seal primer systems.
11. Water meters.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.6 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable flow set points of balancing valves.

C. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

D. Adjust each double-check, detector-assembly backflow preventer in accordance with manufacturer's written instructions, authorities having jurisdiction and the device's reference standard.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections with the assistance of a factory-authorized service representative.

1. Test each double-check, detector-assembly backflow preventer according to authorities having jurisdiction and the device's reference standard.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

END OF SECTION

SECTION 221123.21
INLINE, DOMESTIC-WATER 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. Section Includes:

1. In-line, sealless centrifugal pumps.
2. Horizontally mounted, in-line, separately coupled centrifugal pumps.
3. Horizontally mounted, in-line, close-coupled centrifugal pumps.
4. Vertically mounted, in-line, close-coupled centrifugal pumps.

B. Related Requirements:

1. Section 221123.13 "Domestic-Water Packaged Booster Pumps" for booster systems.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include construction materials, rated capacities, certified performance curves with operating points plotted on curves, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Sustainable Design Submittals:

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Detail pumps and adjacent equipment. Show support locations, type of support, weight on each support, required clearances, and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Structural members to which pumps will be attached.
2. Size and location of initial access modules for acoustical tile.

B. Seismic Qualification Data: Certificates, for inline, domestic-water pumps, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For inline, domestic-water pumps to include in operation and maintenance manuals.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Retain shipping flange protective covers and protective coatings during storage.

B. Protect bearings and couplings against damage.

C. Comply with pump manufacturer's written instructions for handling.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. UL Compliance: UL 778 for motor-operated water pumps.

C. Drinking Water System Components - Health Effects and Drinking Water System Components - Lead Content Compliance: NSF 61 and NSF 372.

2.2 IN-LINE, SEALLESS CENTRIFUGAL PUMPS

A. Description: Factory-assembled and -tested, in-line, close-coupled, canned-motor, sealless, overhung-impeller centrifugal pumps.

B. Taco

C. Capacities and Characteristics:

1. Capacity: 0.5 gpm.
2. Total Dynamic Head: 20 feet.
3. Inlet and Outlet Size: 3/4 NPS.
4. Pump Speed: 3250.
5. Pump Control: Aquastat,Thermostat and Timer.
6. Motor Horsepower: 1/40 HP.
7. Electrical Characteristics:
   a. Volts: 120 V.
   b. Phase: Single phase.
   c. Hertz: 60 Hz.
   d. Full-Load Amperes: 5 A.
   e. Minimum Circuit Ampacity: 0.43 A.
   f. Maximum Overcurrent Protection: 5 A.

D. Pump Construction:

1. Pump and Motor Assembly: Hermetically sealed, replaceable-cartridge type with motor and impeller on common shaft and designed for installation with pump and motor shaft horizontal.
2. Minimum Working Pressure: 125 psig.
3. Maximum Continuous Operating Temperature: 140°F.
4. Casing: Bronze, with threaded or companion-flange connections.
5. Impeller: Bronze.
6. Motor: Single speed.

2.3 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 220513 "Common Motor Requirements for Plumbing 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.

2.4 CONTROLS

A. Pressure Switches: Electric, adjustable for control of Hot water recirc. pump.
   1. Type: Water-immersion pressure sensor, for installation in piping.
   2. Enclosure: NEMA 250, Type 4X.
   3. Operation of Pump: On or off.
   4. Transformer: Provide if required.
   5. Power Requirement: 120 V ac.
   6. Settings: Start pump at 1PSIG and stop pump at 5 PSIG.

B. Thermostats: Electric; adjustable for control of hot-water circulation pump.
   1. Type: Water-immersion temperature sensor, for installation in piping.
   2. Range: 50 to 140°F.
   3. Enclosure: NEMA 250, Type 4X.
   4. Operation of Pump: On or off.
   5. Transformer: Provide if required.
   6. Power Requirement: 120 V ac.
   7. Settings: Start pump at 105 deg F and stop pump at 140 deg **F**.

C. Timers: Electric, for control of hot-water circulation pump.
   1. Type: Programmable, seven-day clock with manual override on-off switch.
   2. Enclosure: NEMA 250, Type 1, suitable for wall mounting.
   3. Operation of Pump: On or off.
   4. Transformer: Provide if required.
   5. Power Requirement: 120 V ac.
   6. Programmable Sequence of Operation: Up to two on-off cycles each day for seven days.

D. Time-Delay Relays: Electric, for control of hot-water circulation pump between water heater and connected hot-water storage tank.
   1. Type: Adjustable time-delay relay.
   2. Range: Up to five minutes.
   3. Setting: Five minutes.
   4. Enclosure: NEMA 250, Type 4X.
   5. Operation of Pump: On or off.
   6. Transformer: Provide if required.
   7. Power Requirement: 120 V ac.
   8. Programmable Sequence of Operation: Limit pump operation to periods of burner operation, plus maximum five minutes after the burner stops.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for domestic-water-piping system to verify actual locations of piping connections before pump installation.

3.2 PUMP INSTALLATION

A. Comply with HI 1.4.

B. Mount pumps in orientation complying with manufacturer's written instructions.

C. Pump Mounting:

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.

D. Install continuous-thread hanger rods and vibration isolation of size required to support pump weight.

1. Comply with requirements for hangers and supports specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

E. Install pressure switches in water-supply piping.

F. Install thermostats in hot-water return piping.

G. Install timers on wall.

H. Install time-delay relays in piping between water heaters and hot-water storage tanks.

3.3 PIPING CONNECTIONS

A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to inline, domestic-water pumps, allow space for service and maintenance.

C. Connect domestic-water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles.

1. Install flexible connectors adjacent to pumps in suction and discharge piping of the following pumps:
   a. Horizontally mounted, in-line, separately coupled centrifugal pumps.
   b. Horizontally mounted, in-line, close-coupled centrifugal pumps.
   c. Vertically mounted, in-line, close-coupled centrifugal pumps.
   d. Comply with requirements for flexible connectors specified in Section 221116 "Domestic Water Piping."

D. Install shutoff valve and strainer on suction side of each pump, and check, shutoff, and throttling valves on discharge side of each pump. Install valves same size as connected piping. Comply with requirements for strainers specified in Section 221119 "Domestic Water Piping Specialties." Comply with requirements for valves specified in the following:

1. Section 220523.12 "Ball Valves for Plumbing Piping."
2. Section 220523.13 "Butterfly Valves for Plumbing Piping."
3. Section 220523.14 "Check Valves for Plumbing Piping."
4. Section 220523.15 "Gate Valves for Plumbing Piping."
5. Install pressure gauge and snubber at suction of each pump and pressure gauge and snubber at discharge of each pump. Install at integral pressure-gauge tappings where provided or install pressure-gauge connectors in suction and discharge piping around pumps. Comply with requirements for pressure gauges and snubbers specified in Section 220519 "Meters and Gages for Plumbing Piping."

3.4 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

B. Connect control wiring between temperature controllers and devices.

C. Interlock pump between water heater and hot-water storage tank with water heater burner and time-delay relay.

3.5 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment" for identification of pumps.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

D. Perform tests and inspections.

E. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

F. Inline, domestic-water pump will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

3.7 STARTUP SERVICE

A. **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. Set thermostats, timers and aquastat for automatic starting and stopping operation of pumps.
5. 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.
6. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
7. Start motor.
8. Open discharge valve slowly.
9. Adjust temperature settings on thermostats.
10. Adjust timer settings.

3.8 ADJUSTING

A. Adjust inline, domestic-water pumps to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust initial temperature set points.

C. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

END OF SECTION

SECTION 221313
FACILITY SANITARY SEWERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Hub-and-spigot, cast-iron soil pipe and fittings.
2. Hubless cast-iron soil pipe and fittings.
3. Cleanouts.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For manholes. Include plans, elevations, sections, details, and frames and covers.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings:

1. Show system piping in profile. Draw profiles to horizontal scale of not less than 1 inch equals 50 feetand to vertical scale of not less than 1 inch equals 5 feet. Indicate manholes and piping. Show types, sizes, materials, and elevations of other utilities crossing system piping.

B. Product Certificates: For each type of pipe and fitting.

C. Field quality-control reports.

PART 2 - PRODUCTS

2.1 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A74, Service class.

B. Gaskets: ASTM C564, rubber.

C. Calking Materials: ASTM B29, pure lead and oakum or hemp fiber.

2.2 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A888 or CISPI 301.

B. CISPI-Trademark, Shielded Couplings:

1. Description: ASTM C1277 and CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C564, rubber sleeve with integral, center pipe stop.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. ANACO-Husky.
   b. Charlotte Pipe and Foundry Company.
   c. Dallas Specialty & Mfg. Co.
   d. Fernco Inc.
   e. Mission Rubber Company, LLC; a division of MCP Industries.
   f. Tyler Pipe; a subsidiary of McWane Inc.

C. Heavy-Duty, Shielded Couplings:

1. Description: ASTM C1277 and ASTM C1540, with stainless-steel shield; stainless-steel bands and tightening devices; and ASTM C564, rubber sleeve with integral, center pipe stop.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ANACO-Husky.

b. Clamp-All Corp.

c. Dallas Specialty & Mfg. Co.

d. Mission Rubber Company, LLC; a division of MCP Industries.

e. Tyler Pipe; a subsidiary of McWane Inc.

2.3 PVC PIPE AND FITTINGS

A. PVC Corrugated Sewer Piping:

1. Pipe: ASTM F949, PVC corrugated pipe with bell-and-spigot ends for gasketed joints.

2. Fittings: ASTM F949, PVC molded or fabricated, socket type.

3. Gaskets: ASTM F477, elastomeric seals.

B. PVC Type PSM Sewer Piping:

1. Pipe: ASTM D3034, **SDR 35**, PVC Type PSM sewer pipe with bell-and-spigot ends for gasketed joints.

2. Fittings: ASTM D3034, PVC with bell ends.

3. Gaskets: ASTM F477, elastomeric seals.

2.4 NONPRESSURE-TYPE TRANSITION COUPLINGS

A. Comply with ASTM C1173, elastomeric, sleeve-type, reducing or transition coupling; for joining underground nonpressure piping. Include ends of same sizes as piping to be joined and include corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials:

1. For Cast-Iron Soil Pipes: ASTM C564, rubber.

2. For Plastic Pipes: ASTM F477, elastomeric seal or ASTM D5926, PVC.

3. For Dissimilar Pipes: ASTM D5926, PVC or other material compatible with pipe materials being joined.

C. Unshielded, Flexible Couplings:

1. Description: Elastomeric sleeve with stainless-steel shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Dallas Specialty & Mfg. Co.

b. Fernco Inc.

c. Logan Clay Pipe.

d. Mission Rubber Company, LLC; a division of MCP Industries.

e. NDS Inc.

f. Plastic Oddities.

D. Ring-Type, Flexible Couplings:

1. Description: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Fernco Inc.
   b. Logan Clay Pipe.
   c. Mission Rubber Company, LLC; a division of MCP Industries.

E. Nonpressure-Type, Rigid Couplings:

1. Description: ASTM C1461, sleeve-type, reducing- or transition-type mechanical coupling; molded from ASTM C1440, TPE material; with corrosion-resistant-metal tension band and tightening mechanism on each end.
2. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. ANACO-Husky.

2.5 CLEANOUTS

A. Cast-Iron Cleanouts:

1. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Jay R. Smith Mfg Co; a division of Morris Group International.
   b. Josam Company.
   c. MIFAB, Inc.
   d. Tyler Pipe; a subsidiary of McWane Inc.
   e. WATTS.
   f. Zurn Industries, LLC.
3. Top-Loading Classification(s): Light Duty and Heavy Duty.
4. Sewer Pipe Fitting and Riser to Cleanout: ASTM A74, Service class, cast-iron soil pipe and fittings.

2.6 ENCASEMENT FOR PIPING

A. Standard: ASTM A674 or AWWA C105/A21.5.

B. Material: Linear low-density polyethylene film of 0.008-inch or high-density, cross-laminated polyethylene film of 0.004-inch] minimum thickness.

C. Form: tube.

D. Color: Black.

2.7 CONCRETE

A. General: Cast-in-place concrete complying with ACI 318, ACI 350, and the following:

1. Cement: ASTM C150/C150M, Type II.
2. Fine Aggregate: ASTM C33/C33M, sand.
3. Coarse Aggregate: ASTM C33/C33M, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A1064/A1064M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A615/A615M, Grade 60 deformed steel.

C. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A1064/A1064M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A615/A615M, Grade 60 deformed steel.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details to indicate general location and arrangement of underground sanitary sewer piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.

F. Install gravity-flow, nonpressure, drainage piping according to the following:

1. Install piping pitched down in direction of flow, at minimum slope of 1 percent unless otherwise indicated.
2. Install piping NPS 6 and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place-concrete supports or anchors.
3. Install piping with 36-inch minimum cover.
4. Install hub-and-spigot, cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
5. Install hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
6. Install PVC corrugated sewer piping according to ASTM D2321 and ASTM F1668.
7. Install PVC Type PSM sewer piping according to ASTM D2321 and ASTM F1668.

G. Install corrosion-protection piping encasement over the following underground metal piping according to ASTM A674 or AWWA C105/A21.5:

1. Hub-and-spigot, cast-iron soil pipe.
2. Hubless cast-iron soil pipe and fittings.
3. Expansion joints and deflection fittings.

H. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.

3.3 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure, drainage piping according to the following:

1. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
2. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.
3. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
4. Join PVC corrugated sewer piping according to ASTM D2321.
5. Join PVC Type PSM sewer piping according to ASTM D2321 and ASTM D3034 for elastomeric-seal joints or ASTM D3034 for elastomeric-gasket joints.
6. Join dissimilar pipe materials with nonpressure-type, flexible couplings.

B. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

1. Use nonpressure flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.
   a. Unshielded flexible couplings for pipes of same or slightly different OD.
   b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
   c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

3.4 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts, and use cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

1. Use Light-Duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
2. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.

B. Set cleanout frames and covers in earth in cast-in-place-concrete block, 18 by 18 by 12 inchesdeep. Set with tops 1 inch above surrounding grade.

C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.5 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping to building's sanitary building drains specified in Section 221316 "Sanitary Waste and Vent Piping."

B. Make connections to existing piping and underground manholes.

1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye fitting plus 6-inch overlap with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
2. Make branch connections from side into existing piping, NPS 4 to NPS 20. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.

3. Make branch connections from side into existing piping, NPS 21 or larger, or to underground manholes by cutting opening into existing unit large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of, and be flush with, inside wall unless otherwise indicated. On outside of pipe or manhole wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.
    a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.
    b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.

3.6 CLOSING ABANDONED SANITARY SEWER SYSTEMS

A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:
    1. Close open ends of piping with at least 8-inch thick, brick masonry bulkheads.
    2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.

B. Backfill to grade according to Section 312000 "Earth Moving."

3.7 IDENTIFICATION

A. Comply with requirements in Section 312000 "Earth Moving" for underground utility identification devices. Arrange for installation of green warning tapes directly over piping and at outside edges of underground manholes.
    1. Use warning tape or detectable warning tape over ferrous piping.
    2. Use detectable warning tape over nonferrous piping and over edges of underground manholes.

3.8 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inchesof backfill is in place, and again at completion of Project.
    1. Submit separate report for each system inspection.
    2. Defects requiring correction include the following:
        a. Alignment: Less than full diameter of inside of pipe is visible between structures.
        b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
        c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
        d. Infiltration: Water leakage into piping.
        e. Exfiltration: Water leakage from or around piping.
    3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
    4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
    1. Do not enclose, cover, or put into service before inspection and approval.
    2. Test completed piping systems according to requirements of authorities having jurisdiction.

3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. Submit separate report for each test.
5. Hydrostatic Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:
    a. Fill sewer piping with water. Test with pressure of at least 10-foot head of water, and maintain such pressure without leakage for at least 15 minutes.
    b. Close openings in system and fill with water.
    c. Purge air and refill with water.
    d. Disconnect water supply.
    e. Test and inspect joints for leaks.
6. Manholes: Perform hydraulic test according to ASTM C969.

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

END OF SECTION

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SECTION 221316
SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Hubless, cast-iron soil pipe and fittings.
2. PVC pipe and fittings.
3. Specialty pipe fittings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For waste and vent piping, accessories, and components, from manufacturer.

B. Field quality-control reports.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water.

B. Seismic Performance: Soil, waste, and vent piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

2.2 PIPING MATERIALS

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. CISPI, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. ANACO-Husky.
   b. Dallas Specialty & Mfg. Co.
   c. Fernco Inc.
   d. Matco-Norca, Inc.
   e. MIFAB, Inc.
   f. Mission Rubber Company; a division of MCP Industries, Inc.
   g. Stant.
   h. Tyler Pipe.
2. Standards: ASTM C 1277 and CISPI 310.
3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

C. Heavy-Duty, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ANACO-Husky.

b. Clamp-All Corp.

c. Dallas Specialty & Mfg. Co.

d. MIFAB, Inc.

e. Mission Rubber Company; a division of MCP Industries, Inc.

f. Stant.

g. Tyler Pipe.

2. Standards: ASTM C 1277 and ASTM C 1540.
3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.4 PVC PIPE AND FITTINGS

A. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

B. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
C. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
D. Adhesive Primer: ASTM F 656.
E. Solvent Cement: ASTM D 2564.

2.5 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

2. Unshielded, Nonpressure Transition Couplings:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Dallas Specialty & Mfg. Co.

2) Fernco Inc.

3) Froet Industries LLC.

b. Standard: ASTM C 1173.
c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
d. End Connections: Same size as and compatible with pipes to be joined.
e. Sleeve Materials:

1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.

2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.

3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

3. Shielded, Nonpressure Transition Couplings:
    a. Manufacturers: Subject to compliance with requirements, provide products by the following:
        1) Cascade Waterworks Mfg. Co.
    b. Standard: ASTM C 1460.
    c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
    d. End Connections: Same size as and compatible with pipes to be joined.

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.
    1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
    2. 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. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

K. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.
    1. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.
    2. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe.
        a. Straight tees, elbows, and crosses may be used on vent lines.
    3. Do not change direction of flow more than 90 degrees.
    4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.
        a. Reducing size of waste piping in direction of flow is prohibited.

L. Lay buried building waste piping beginning at low point of each system.

1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.

2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

3. Maintain swab in piping and pull past each joint as completed.

M. Install soil and waste and vent piping at the following minimum slopes unless otherwise indicated:

1. Building Sanitary Waste: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.

2. Horizontal Sanitary Waste Piping: 2 percent downward in direction of flow.

3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

N. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

O. Install aboveground PVC piping according to ASTM D 2665.

P. Install underground PVC piping according to ASTM D 2321.

Q. Plumbing Specialties:

1. Install backwater valves in sanitary waster gravity-flow piping.

a. Comply with requirements for backwater valves specified in Section 221319 "Sanitary Waste Piping Specialties."

2. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary waste gravity-flow piping.

a. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."

3. Install drains in sanitary waste gravity-flow piping.

a. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."

R. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

S. Install sleeves for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

T. Install sleeve seals for piping penetrations of concrete walls and slabs.

1. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

U. Install escutcheons for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.

C. Grooved Joints: Cut groove ends of pipe according to AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections, over gasket, with keys seated in piping grooves. Install and tighten housing bolts.

D. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 appendixes.
3. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 appendixes.

3.4 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in ODs.

2. In Waste Drainage Piping: Shielded, nonpressure transition couplings.

3.5 VALVE INSTALLATION

A. Comply with requirements in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," Section 220523.14 "Check Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping" for general-duty valve installation requirements.

B. Shutoff Valves:

1. Install shutoff valve on each sewage pump discharge.
2. Install gate or full-port ball valve for piping NPS 2 and smaller.
3. Install gate valve for piping NPS 2-1/2 and larger.

C. Check Valves: Install swing check valve, between pump and shutoff valve, on each sewage pump discharge.

D. Backwater Valves: Install backwater valves in piping subject to backflow.

1. Horizontal Piping: Horizontal backwater valves. Use normally closed type unless otherwise indicated.
2. Floor Drains: Drain outlet backwater valves unless drain has integral backwater valve.
3. Install backwater valves in accessible locations.
4. Comply with requirements for backwater valve specified in Section 221319 "Sanitary Waste Piping Specialties."

3.6 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment." Section 220548.13 "Vibration Controls for Plumbing Piping and Equipment."

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
5. Vertical Piping: MSS Type 8 or Type 42, clamps.
6. Install individual, straight, horizontal piping runs:
   a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
   b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.

c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.

8. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.

2. NPS 3: 60 inches with 1/2-inch rod.

3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.

4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.

5. NPS 10 and NPS 12: 60 inches with 7/8-inch rod.

6. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

G. Install supports for vertical cast-iron soil piping every 15 feet.

H. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.

2. NPS 3: 48 inches with 1/2-inch rod.

3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.

4. NPS 6 and NPS 8: 48 inches with 3/4-inch rod.

5. NPS 10 and NPS 12: 48 inches with 7/8-inch rod.

I. Install supports for vertical PVC piping every 48 inches.

J. Support piping and tubing not listed above according to MSS SP-58 and manufacturer's written instructions.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect waste and vent piping to the following:

1. Plumbing Fixtures: Connect waste piping in sizes indicated, but not smaller than required by plumbing code.

2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.

3. Plumbing Specialties: Connect waste and vent piping in sizes indicated, but not smaller than required by plumbing code.

4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.

5. Install horizontal backwater valves with cleanout cover flush with floor.

6. Comply with requirements for backwater valves cleanouts and drains specified in Section 221319 "Sanitary Waste Piping Specialties."

7. Equipment: Connect waste piping as indicated.
    a. Provide shutoff valve if indicated and union for each connection.
    b. Use flanges instead of unions for connections NPS 2-1/2 and larger.

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

E. Make connections according to the following unless otherwise indicated:
    1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
    2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.8 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping.

B. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.9 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
    1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
    2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary waste and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
    1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.
        a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
    2. Leave uncovered and unconcealed new, altered, extended, or replaced waste and vent piping until it has been tested and approved.
        a. Expose work that was covered or concealed before it was tested.
    3. Roughing-in Plumbing Test Procedure: Test waste and vent piping except outside leaders on completion of roughing-in.
        a. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water.
        b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
        c. Inspect joints for leaks.
    4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight.
        a. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg.
        b. Use U-tube or manometer inserted in trap of water closet to measure this pressure.

c. Air pressure must remain constant without introducing additional air throughout period of inspection.

d. Inspect plumbing fixture connections for gas and water leaks.

5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.

6. Prepare reports for tests and required corrective action.

3.10 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

D. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

E. Repair damage to adjacent materials caused by waste and vent piping installation.

3.11 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground, soil and waste piping NPS 4 and smaller shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.

2. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

C. Aboveground, soil and waste piping NPS 5 and larger shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.

2. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

D. Aboveground, vent piping NPS 4 and smaller shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.

2. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

E. Underground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:

1. Service class, cast-iron soil piping; gaskets; and gasketed joints.

2. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

END OF SECTION

SECTION 221319
SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Backwater valves.
2. Cleanouts.
3. Roof flashing assemblies.
4. Miscellaneous sanitary drainage piping specialties.

B. Related Requirements:

1. Section 221423 "Storm Drainage Piping Specialties" for trench drains for storm water, channel drainage systems for storm water, roof drains, and catch basins.
2. Section 224300 "Healthcare Plumbing Fixtures" for plaster sink interceptors.
3. Section 334200 "Stormwater Conveyance" for storm drainage piping and piping specialties outside the building.

1.2 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene.

B. PVC: Polyvinyl chloride.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTIONS

A. Sanitary waste piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14 for plastic sanitary waste piping specialty components.

2.2 BACKWATER VALVES

A. Horizontal, Cast-Iron Backwater Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Jay R. Smith Mfg. Co.
   b. Josam Company.
   c. MIFAB, Inc.
   d. Tyler Pipe; a subsidiary of McWane Inc.
   e. WATTS.
2. Standard: ASME A112.14.1.
3. Size: Same as connected piping.
4. Body: Cast iron.
5. Cover: Cast iron with bolted or threaded access check valve.
6. End Connections: Hubless.

7. Type Check Valve: Removable, bronze, swing check, factory assembled or field modified to hang closed.
8. Extension: ASTM A 74, Service class; full-size, cast-iron, soil-pipe extension to field-installed cleanout at floor; replaces backwater valve cover.

B. Horizontal, Plastic Backwater Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Canplas LLC.
   b. IPS Corporation.
   c. NDS Inc.
   d. Oatey.
   e. Plastic Oddities.
   f. Sioux Chief Manufacturing Company, Inc.
2. Size: Same as connected piping.
3. Body: PVC.
4. Cover: Same material as body with threaded access to check valve.
5. Check Valve: Removable swing check.
6. End Connections: Socket type.

2.3 CLEANOUTS

A. Cast-Iron Exposed Cleanouts:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Jay R. Smith Mfg. Co.
   b. Josam Company.
   c. MIFAB, Inc.
   d. Tyler Pipe; a subsidiary of McWane Inc.
   e. WATTS.
2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
3. Size: Same as connected drainage piping
4. Body Material: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk or raised-head, brass or plastic plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Closure: Stainless-steel plug with seal.

B. Cast-Iron Exposed Floor Cleanouts:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Jay R. Smith Mfg. Co.
   b. Josam Company.
   c. Oatey.
   d. Sioux Chief Manufacturing Company, Inc.
   e. Tyler Pipe; a subsidiary of McWane Inc.
   f. WATTS.

2. Standard: ASME A112.36.2M for heavy-duty, adjustable housing cleanout.
3. Size: Same as connected branch.
4. Type: Heavy-duty, adjustable housing.
5. Body or Ferrule: Cast iron.
6. Clamping Device: Not required.
7. Outlet Connection: Inside calk.
8. Closure: Brass plug with tapered threads.
9. Adjustable Housing Material: Cast iron with setscrews or other device.
10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
11. Frame and Cover Shape: Round.
12. Top Loading Classification: Heavy Duty.
13. Riser: ASTM A 74, Extra-Heavy class, cast-iron drainage pipe fitting and riser to cleanout.

C. Cast-Iron Wall Cleanouts:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Jay R. Smith Mfg. Co.
   b. Josam Company.
   c. MIFAB, Inc.
   d. Tyler Pipe; a subsidiary of McWane Inc.
   e. WATTS.
2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure Plug:
   a. Brass.
   b. Countersunk or raised head.
   c. Drilled and threaded for cover attachment screw.
   d. Size: Same as or not more than one size smaller than cleanout size.
6. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.
7. Wall Access: Round, nickel-bronze, copper-alloy, or stainless-steel wall-installation frame and cover.

D. Plastic Floor Cleanouts:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Canplas LLC.
   b. IPS Corporation.
   c. NDS Inc.
   d. Plastic Oddities.
   e. Sioux Chief Manufacturing Company, Inc.
2. Size: Same as connected branch.
3. Body: PVC.
4. Closure Plug: PVC.

5. Riser: Drainage pipe fitting and riser to cleanout of same material as drainage piping.

2.4 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Acorn Engineering Company.
   b. Thaler Metal Industries Ltd.
2. Description: Manufactured assembly made of 4.0-lb/sq. ft., 0.0625-inch- thick, lead flashing collar and skirt extending at least 8 inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.
   a. Open-Top Vent Cap: Without cap.
   b. Low-Silhouette Vent Cap: With vandal-proof vent cap.
   c. Extended Vent Cap: With field-installed, vandal-proof vent cap.

2.5 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Open Drains:

1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564 rubber gaskets.
2. Size: Same as connected waste piping with increaser fitting of size indicated.

B. Deep-Seal Traps:

1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
2. Size: Same as connected waste piping.
   a. NPS 2: 4-inch-minimum water seal.
   b. NPS 2-1/2 and Larger: 5-inch-minimum water seal.

C. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

D. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 2 inches above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

E. Stack Flashing Fittings:

1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

F. Expansion Joints:

1. Standard: ASME A112.6.4.
2. Body: Cast iron with bronze sleeve, packing, and gland.
3. End Connections: Matching connected piping.
4. Size: Same as connected soil, waste, or vent piping.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install backwater valves in building drain piping.

1. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.

B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

E. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof. Comply with requirements in Section 076200, Sheet Metal Flashing and Trim.

F. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof. Comply with requirements in Section 076200, Sheet Metal Flashing and Trim.

G. Assemble open drain fittings and install with top of hub 1 inch above floor.

H. Install deep-seal traps on floor drains and other waste outlets, if indicated.

I. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

J. Install sleeve and sleeve seals with each riser and stack passing through floors with waterproof membrane.

K. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.

L. Install wood-blocking reinforcement for wall-mounting-type specialties.

M. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.2 CONNECTIONS

A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.3 FLASHING INSTALLATION

A. Comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."

B. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required.

C. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

D. Set flashing on floors and roofs in solid coating of bituminous cement.

E. Secure flashing into sleeve and specialty clamping ring or device.

F. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Section 076200 "Sheet Metal Flashing and Trim."

G. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

3.4 LABELING AND IDENTIFYING

A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.

1. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.5 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

SECTION 221319.13
SANITARY DRAINS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Floor drains.

1.2 DEFINITIONS

A. ABS: Acrylonitrile-butadiene styrene.

B. FRP: Fiberglass-reinforced plastic.

C. HDPE: High-density polyethylene.

D. PE: Polyethylene.

E. PP: Polypropylene.

F. PVC: Polyvinyl chloride.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 DRAIN ASSEMBLIES

A. Sanitary drains shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14 for plastic sanitary piping specialty components.

2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Jay R. Smith Mfg. Co.
   b. Josam Company.
   c. Wade; a subsidiary of McWane Inc.
   d. WATTS.
2. Standard: ASME A112.6.3.
3. Pattern: Floor drain.
4. Body Material: Gray iron.
5. Seepage Flange: Not Required.
6. Anchor Flange: Required.
7. Clamping Device: Not required.
8. Outlet: Bottom.
9. Backwater Valve: Not required.
10. Coating on Interior and Exposed Exterior Surfaces: Acid-resistant enamel.
11. Sediment Bucket: See schedule on drawings.
12. Top or Strainer Material: Nickel bronze.
13. Top of Body and Strainer Finish: Nickel bronze.
14. Top Shape: Round.
15. Dimensions of Top or Strainer: See schedule on drawings .

16. Top Loading Classification: Heavy Duty.
17. Funnel: Not required.
18. Inlet Fitting: Not required.
19. Trap Material: Cast iron.
20. Trap Pattern: Deep-seal P-trap.
21. Trap Features: Not required.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage.
3. Set with grates depressed according to the following drainage area radii:
   a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
   b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
   c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.
4. Install floor-drain flashing collar or flange, so no leakage occurs between drain and adjoining flooring.

a. Maintain integrity of waterproof membranes where penetrated.

5. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

B. Install trench drains at low points of surface areas to be drained.

1. Set grates of drains flush with finished surface, unless otherwise indicated.
2. Install on support devices, so that top will be flush with adjacent surface.

C. Install open drain fittings with top of hub 1 inch above floor.

3.2 CONNECTIONS

A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Comply with requirements in Section 221319 "Sanitary Waste Piping Specialties" for backwater valves, air admittance devices and miscellaneous sanitary drainage piping specialties.

C. Comply with requirements in Section 221323 "Sanitary Waste Interceptors" for grease interceptors, grease-removal devices, oil interceptors, sand interceptors, and solid interceptors.

D. Install piping adjacent to equipment to allow service and maintenance.

E. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

F. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.3 LABELING AND IDENTIFYING

A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

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SECTION 221413
FACILITY STORM DRAINAGE 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. Hub-and-spigot, cast-iron soil pipe and fittings.
2. Hubless, cast-iron soil pipe and fittings.
3. Galvanized-steel pipe and fittings.
4. Ductile-iron pipe and fittings.
5. Copper tube and fittings.
6. ABS pipe and fittings.
7. PVC pipe and fittings.
8. Specialty pipe and fittings.
9. Encasement for underground metal piping.

B. Related Requirements:

1. Section 334400 "Stormwater Utility Equipment" for storm drainage piping outside the building.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Detail storm drainage piping. Show support locations, type of support, weight on each support, required clearances, and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Structural members to which drainage piping will be attached or suspended from.

B. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

1.6 FIELD CONDITIONS

A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Architect no fewer than two days in advance of proposed interruption of storm drainage service.
2. Do not proceed with interruption of storm drainage service without Architect's written permission.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Storm Drainage Piping: 10-foot head of water.

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Tyler Pipe

B. Pipe and Fittings:

1. Marked with CISPI collective trademark and NSF certification mark.
2. Class: ASTM A 74, Service class(es).

C. Gaskets: ASTM C 564, rubber.

D. Caulking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Tyler Pipe

B. CISPI, Hubless-Piping Couplings:

1. Tyler Pipe
2. Couplings shall bear CISPI collective trademark.
3. Standards: ASTM C 1277 and CISPI 310.
4. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

C. Heavy-Duty, Hubless-Piping Couplings:

1. Tyler Pipe
2. Standard: ASTM C 1540.
3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

D. Cast-Iron, Hubless-Piping Couplings:

1. Charlotte Pipe and Foundry
2. Standard: ASTM C 1277.
3. Description: Two-piece ASTM A 48/A 48M, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.4 GALVANIZED-STEEL PIPE AND FITTINGS

A. US Steel

B. Pipe: ASTM A 53/A 53M, Type E, Standard Weight class. Include square-cut-grooved or threaded ends matching joining method.

C. Cast-Iron Drainage Fittings: ASME B16.12, threaded.

D. Steel-Pipe Pressure Fittings:

1. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106/A 106M, Schedule 40, seamless steel pipe. Include ends matching joining method.
2. Malleable-Iron Unions: ASME B16.39; Class 150; hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface; and female threaded ends.
3. Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, standard pattern.

E. Cast-Iron Flanges: ASME B16.1, Class 125.

1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

F. Grooved-Joint, Galvanized-Steel-Pipe Appurtenances

1. Victaulic Company

2. Galvanized, Grooved-End Fittings for Galvanized-Steel Piping: ASTM A 536 ductile-iron castings, ASTM A 47/A 47M malleable-iron castings, ASTM A 234/A 234M forged-steel fittings, or ASTM A 106/A 106M steel pipes with dimensions matching ASTM A 53/A 53M steel pipe, and complying with AWWA C606 for grooved ends.

3. Grooved Mechanical Couplings for Galvanized-Steel Piping: ASTM F 1476, Type I. Include ferrous housing sections with continuous curved keys; EPDM-rubber gasket suitable for hot and cold water; and bolts and nuts.

2.5 DUCTILE-IRON PIPE AND FITTINGS

A. American Ductile Iron Pipe.

B. Ductile-Iron, Mechanical-Joint Piping:

1. Ductile-Iron Pipe: AWWA C151/A21.51, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.

2. Ductile-Iron Fittings: AWWA C110/A21.10, mechanical-joint ductile- or gray-iron standard pattern or AWWA C153/A21.53, ductile-iron compact pattern.

3. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

C. Ductile-Iron, Push-on-Joint Piping:

1. Ductile-Iron Pipe: AWWA C151/A21.51, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.

2. Ductile-Iron Fittings: AWWA C110/A21.10, push-on-joint ductile- or gray-iron standard pattern or AWWA C153/A21.53, ductile-iron compact pattern.

3. Gaskets: AWWA C111/A21.11, rubber.

D. Ductile-Iron, Grooved-Joint Piping:

1. Ductile-Iron Pipe: AWWA C151/A21.51, with round-cut-grooved ends according to AWWA C606.

2. Ductile-Iron, Grooved-End Pipe Appurtenances:

a. Victaulic Company

b. Grooved-End, Ductile-Iron Fittings: ASTM A 536, ductile-iron castings with dimensions matching AWWA C110/A21.10, ductile-iron pipe or AWWA C153/A21.53, ductile-iron fittings; complying with AWWA C606 for grooved ends.

c. Grooved Mechanical Couplings for Ductile-Iron Pipe: ASTM F 1476, Type I. Include ferrous housing sections with continuous curved keys; EPDM-rubber center-leg gasket suitable for hot and cold water; and bolts and nuts.

2.6 COPPER TUBE AND FITTINGS

A. Cambridge-Lee Industries, LLC

B. Copper Type DWV Tube: ASTM B 306, drainage tube, drawn temper.

C. Copper Drainage Fittings: ASME B16.23, cast-copper fittings or ASME B16.29, wrought-copper, solder-joint fittings.

D. Hard Copper Tube: ASTM B 88, Type L, water tube, drawn temper.

E. Soft Copper Tube: ASTM B 88, Type L, water tube, annealed temper.

F. Copper Pressure Fittings:

1. Copper Fittings: ASME B16.18, cast-copper-alloy fittings or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.

2. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

G. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.

1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

H. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

2.7 ABS PIPE AND FITTINGS

A. JM Eagle Manufacturing Co.

B. NSF Marking: Comply with NSF 14, "Plastics Piping System Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic storm drain and "NSF-sewer" for plastic storm sewer piping.

C. Solid-Wall ABS Pipe: ASTM D 2661, Schedule 40.

D. Cellular-Core ABS Pipe: ASTM F 628, Schedule 40.

E. ABS Socket Fittings: ASTM D 2661, made to ASTM D 3311, drain, waste, and vent patterns.

F. Solvent Cement: ASTM D 2235.

2.8 PVC PIPE AND FITTINGS

A. JM Eagle Manufacturing Co.

B. NSF Marking: Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic storm drain and "NSF-sewer" for plastic storm sewer piping.

C. Solid-Wall PVC Pipe: ASTM D 2665; drain, waste, and vent.

D. Cellular-Core PVC Pipe: ASTM F 891, Schedule 40.

E. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

F. Adhesive Primer: ASTM F 656.

G. Solvent Cement: ASTM D 2564.

2.9 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in ODs or of different materials. Include end connections same size as and compatible with pipes to be joined.

2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified-piping-system fitting.

3. Unshielded, Nonpressure Transition Couplings:

a. Dallas Specialty & Mfg.Co.

b. Standard: ASTM C 1173.

c. Description: Elastomeric sleeve, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.

d. Sleeve Materials:

1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.

2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.

3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

4. Shielded, Nonpressure Transition Couplings:

a. Mission Rubber Co.

b. Standard: ASTM C 1460.

c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

d. End Connections: Same size as and compatible with pipes to be joined.

5. Pressure Transition Couplings:

a. Ford Meter Box Co. Inc.

b. Standard: AWWA C219.

c. Description: Metal, sleeve-type couplings same size as pipes to be joined, and with pressure rating at least equal to and ends compatible with pipes to be joined.

d. Center-Sleeve Material: Manufacturer's standard, Ductile iron.

e. Gasket Material: Natural or synthetic rubber.

f. Metal Component Finish: Corrosion-resistant coating or material.

B. Dielectric Fittings:

1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

2. Dielectric Unions:

a. Watts

b. Description:

1) Standard: ASSE 1079.

2) Pressure Rating: 150 psig.

3) End Connections: Solder-joint copper alloy and threaded ferrous.

3. Dielectric Flanges:

a. Watts

b. Description:

1) Standard: ASSE 1079.

2) Factory-fabricated, bolted, companion-flange assembly.

3) Pressure Rating: 150 psig minimum at 180°F.

4) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

4. Dielectric-Flange Insulating Kits:

a. Advance Products & Systems, LLC

b. Description:

1) Nonconducting materials for field assembly of companion flanges.

2) Pressure Rating: 150 psig.
3) Gasket: Neoprene or phenolic.
4) Bolt Sleeves: Phenolic or polyethylene.
5) Washers: Phenolic with steel-backing washers.

5. Dielectric Nipples:
   a. Victaulic Co.
   b. Description: Electroplated steel nipple.
   c. Standard: IAPMO PS 66.
   d. Pressure Rating: 300 psig at 225 deg F.
   e. End Connections: Male threaded or grooved.
   f. Lining: Inert and noncorrosive, propylene.

2.10 ENCASEMENT FOR UNDERGROUND METAL PIPING

A. Standard: ASTM A 674 or AWWA C105/A 21.5.

B. Material: High-density, crosslaminated polyethylene film of 0.004-inch minimum thickness.

C. Form: tube.

D. Color: Black..

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.
   1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
   2. Install piping as indicated unless deviations from 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. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

K. Make changes in direction for piping using appropriate branches, bends, and long-sweep bends.

1. Do not change direction of flow more than 90 degrees.

2. Use proper size of standard increasers and reducers if pipes of different sizes are connected.

a. Reducing size of drainage piping in direction of flow is prohibited.

L. Lay buried building piping beginning at low point of each system.

1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.

2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

3. Maintain swab in piping and pull past each joint as completed.

M. Install piping at the following minimum slopes unless otherwise indicated:

1. Building Storm Drain: **2** percent downward in direction of flow for piping NPS 3 and smaller; 1 > percent downward in direction of flow for piping NPS 4 and larger.

2. Horizontal Storm Drainage Piping: **2** percent downward in direction of flow.

N. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Install encasement on underground piping according to ASTM A 674 or AWWA C105/A 21.5.

O. Install steel piping according to applicable plumbing code.

P. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."

Q. Install aboveground ABS piping according to ASTM D 2661.

R. Install aboveground PVC piping according to ASTM D 2665.

S. Install underground PVC piping according to ASTM D 2321.

T. Install engineered controlled-flow drain specialties and storm drainage piping in locations indicated.

U. Install underground, ductile-iron, force-main piping according to AWWA C600.

1. Install buried piping inside building between wall and floor penetrations and connection to storm sewer piping outside building with restrained joints.

2. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.

3. Install encasement on piping according to ASTM A 674 or AWWA C105/A 21.5.

V. Install underground, copper, force-main tubing according to CDA's "Copper Tube Handbook."

1. Install encasement on piping according to ASTM A 674 or AWWA C105/A 21.5.

W. Install force mains at elevations indicated.

X. Plumbing Specialties:

1. Install backwater valves in storm drainage gravity-flow piping.

a. Comply with requirements for backwater valves specified in Section 221423 "Storm Drainage Piping Specialties."

2. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers in storm drainage gravity-flow piping.

a. Install cleanout fitting with closure plug inside the building in storm drainage force-main piping.

b. Comply with requirements for cleanouts specified in Section 221423 "Storm Drainage Piping Specialties."

3. Install drains in storm drainage gravity-flow piping.

a. Comply with requirements for drains specified in Section 221423 "Storm Drainage Piping Specialties."

Y. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

Z. Install sleeves for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

AA. Install sleeve seals for piping penetrations of concrete walls and slabs.

1. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

BB. Install escutcheons for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Hub-and-Spigot, Cast-Iron Soil Piping Gasketed Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Hub-and-Spigot, Cast-Iron Soil Piping Caulked Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum caulked joints.

C. Hubless, Cast-Iron Soil Piping Coupled Joints:

1. Join according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1.

1. Cut threads full and clean using sharp dies.

2. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

a. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

c. Do not use pipe sections that have cracked or open welds.

E. Join copper tube and fittings with soldered joints according to ASTM B 828 procedure. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.

F. Grooved Joints: Cut groove ends of pipe according to AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fittings. Install coupling housing sections, over gasket, with keys seated in piping grooves. Install and tighten housing bolts.

G. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

H. Plastic, Nonpressure-Piping, Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.

2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 appendices.

3. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 appendices.

I. Joint Restraints and Sway Bracing:

1. Provide joint restraints and sway bracing for storm drainage piping joints to comply with the following conditions:

a. Provide axial restraint for pipe and fittings 5 inches and larger, upstream and downstream of all changes in direction, branches, and changes in diameter greater than two pipe sizes.

b. Provide rigid sway bracing for pipe and fittings 4 inches and larger, upstream and downstream of all changes in direction 45 degrees and greater.

c. Provide rigid sway bracing for pipe and fittings 5 inches and larger, upstream and downstream of all changes in direction and branch openings.

3.4 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in ODs.

2. In Drainage Piping: Shielded, nonpressure transition couplings.

3. In Aboveground Force-Main Piping: Fitting-type transition couplings.

4. In Underground Force-Main Piping:

a. NPS 1-1/2 and Smaller: Fitting-type transition couplings.

b. NPS 2 and Larger: Pressure transition couplings.

B. Dielectric Fittings:

1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

2. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.

3. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.

4. Dielectric Fittings for NPS 6 and Larger: Use dielectric flange kits.

3.5 VALVE INSTALLATION

A. General valve installation requirements for general-duty valve installations are specified in the following Sections:

1. Section 220523.14 "Check Valves for Plumbing Piping."

B. Shutoff Valves:

1. Install shutoff valve on each sump pump discharge.

2. Install full port ball valve for piping NS 2 and smaller.

3. Install gate valve for piping NPS 2-1/2 and larger.

C. Check Valves: Install swing-check valve, between pump and shutoff valve, on each sump pump discharge.

D. Backwater Valves: Install backwater valves in piping subject to backflow.

1. Horizontal Piping: Horizontal backwater valves. Use normally closed type unless otherwise indicated.

2. Install backwater valves in accessible locations.

3. Comply with requirements for backwater valves specified in Section 221423 "Storm Drainage Piping Specialties."

3.6 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for hangers, supports, and anchor devices specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
5. Vertical Piping: MSS Type 8 or Type 42, clamps.
6. Install individual, straight, horizontal piping runs:
   a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
   b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
   c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
8. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Install hangers for cast-iron, ductile iron and copper soil tubing and piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

D. Install hangers for PVC 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 and tubing within 12 inches of each fitting, valve and coupling.

F. Support vertical cast-iron, ductile iron and copper tubing and piping to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent, but as a minimum at base and at each floor.

G. Support vertical ABS and PVC piping with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.

C. Connect storm drainage piping to roof drains and storm drainage specialties.

1. Install test tees (wall cleanouts) in conductors near floor, and floor cleanouts with cover flush with floor.
2. Install horizontal backwater valves with cleanout cover flush with floor.
3. Comply with requirements for cleanouts and drains specified in Section 221423 "Storm Drainage Piping Specialties."

D. Connect force-main piping to the following:

1. Storm Sewer: To exterior force main.
2. Sump Pumps: To sump pump discharge.

E. Where installing piping adjacent to equipment, allow space for service and maintenance.

F. Make connections according to the following unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.8 IDENTIFICATION

A. Identify exposed storm drainage piping.

B. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.9 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.

2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Test storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.

a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved.

a. Expose work that was covered or concealed before it was tested.

3. Test Procedure:

a. Test storm drainage piping**,** except outside leaders**,** on completion of roughing-in.

b. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts until completion of inspection, water level must not drop. Inspect joints for leaks.

4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.

5. Prepare reports for tests and required corrective action.

C. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved.

a. Expose work that was covered or concealed before it was tested.

2. Cap and subject piping to static-water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials.

a. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.

3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.

4. Prepare reports for tests and required corrective action.

D. Piping will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.10 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.11 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground storm drainage piping NPS 6 and smaller shall be the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; hubless-piping couplings; and coupled joints.
3. Galvanized-steel pipe, drainage fittings, and threaded joints.
4. Copper Type DWV tube, copper drainage fittings, and soldered joints.
5. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
6. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

C. Aboveground, storm drainage piping NPS 8 and larger shall be the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; hubless-piping couplings; and coupled joints.
3. Galvanized-steel pipe, drainage fittings, and threaded joints.
4. Copper Type DWV tube, copper drainage fittings, and soldered joints.
5. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
6. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

D. Underground storm drainage piping NPS 6 and smaller shall be the following:

1. **Service** class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; cast-iron**,** hubless-piping couplings; and coupled joints.
3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
4. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

E. Underground, storm drainage piping NPS 8 and larger shall be the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; cast-iron**,** hubless-piping couplings; and coupled joints.
3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
4. Cellular-core, sewer and drain series, PVC pipe; PVC socket fittings; and solvent-cemented joints.
5. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

F. Aboveground storm drainage force mains NPS 1-1/2 and NPS 2 shall be the following:

1. Hard copper tube, Type L copper pressure fittings, and soldered joints.
2. Galvanized-steel pipe, pressure fittings, and threaded joints.

G. Aboveground storm drainage force mains NPS 2-1/2 to NPS 6 shall be the following:

1. Hard copper tube, Type L copper pressure fittings, and soldered joints.
2. Galvanized-steel pipe, pressure fittings, and threaded joints.
3. Grooved-end, galvanized-steel pipe; grooved-joint, galvanized-steel-pipe appurtenances; and grooved joints.
4. Fitting-type transition couplings if dissimilar pipe materials.

H. Underground storm drainage force mains NPS 4 and smaller shall be the following:

1. Hard copper tube; Type L wrought-copper pressure fittings; and soldered joints.
2. Ductile-iron, mechanical-joint piping and mechanical joints.
3. Ductile-iron, push-on-joint piping and push-on joints.
4. Ductile-iron, grooved-joint piping and grooved joints.
5. Fitting-type transition coupling for piping smaller than NPS 1-1/2 and pressure transition coupling for NPS 1-1/2 and larger if dissimilar pipe materials.

END OF SECTION

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SECTION 221423
STORM DRAINAGE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Metal roof drains.
   2. Plastic roof drains.
   3. Miscellaneous storm drainage piping specialties.
   4. Cleanouts.
   5. Backwater valves.
   6. Trench drains.
   7. Channel drainage systems.

B. Related Requirements:
   1. Section 076200 "Sheet Metal Flashing and Trim" for penetrations of roofs.
   2. Section 078413 "Penetration Firestopping" for firestopping roof penetrations.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 METAL ROOF DRAINS

A. Cast-Iron, Large-Sump, General-Purpose Roof Drains RD-ORD-1:
   1. Zurn Industries, LLC
   2. Standard: ASME A112.6.4.
   3. Body Material: Cast iron.
   4. Dimension of Body: Nominal 14-diameter.
   5. Combination Flashing Ring and Gravel Stop: Required.
   6. Flow-Control Weirs: Required.
   7. Outlet: Bottom.
   8. Outlet Type: Inside caulk, Threaded..
   9. Extension Collars: Required.
   10. Underdeck Clamp: Required.
   11. Expansion Joint: Required.
   12. Sump Receiver Plate: Required.
   13. Dome Material: Cast iron,PE.
   14. Perforated Gravel Guard: Stainless steel.
   15. Vandal-Proof Dome: Not required.

16. Water Dam: 2 inches high.

2.2 MISCELLANEOUS STORM DRAINAGE PIPING SPECIALTIES

A. Downspout Adapters:

1. Description: Manufactured, gray-iron casting, for attaching to horizontal-outlet, parapet roof drain and to exterior sheet metal downspout.
2. Size: Inlet size to match parapet drain outlet.

B. Downspout Boots:

1. Watts
2. Description: Manufactured, ASTM A48/A48M, gray-iron casting, with strap or ears for attaching to building; NPS 4 outlet; and shop-applied bituminous coating.
3. Size: Inlet size to match downspout and NPS 4 outlet.

C. Metal Downspout Nozzles DSN-1:

1. Jay R. Smith MFG CO, Watts, Zurn, Josam Co.
2. Description: Nozzle with wall flange and mounting holes to cover rough opening and serve as anchor..
3. Size: Same as connected downspout.
4. Material: Cast bronze or nickel bronze nozzle and flange.
5. Piping Connection Type: Threaded or Slip on.
6. Finish: Bronze.
7. Opening Protection: Birdscreen.

2.3 CLEANOUTS

A. Cast-Iron Exposed Cleanouts FCO:

1. J R smith MFG CO, Josam Co, Watts, Zurn Industries, LLC.
2. Standard: ASME A112.36.2M.
3. Size: Same as connected branch.
4. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch, No-hub, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk or raised-head, brass, cast-iron, plastic(exterior) non-traffic areas. plug.
6. Closure Plug Size: Same as, or not more than, one size smaller than cleanout size.

B. Cast-Iron Exposed Floor Cleanouts FCO:

1. JR Smith Mfg CO, Josam CO, Sioux Chief Manuf., Watts, Zurn.
2. Standard: ASME A112.36.2M.
3. Size: Same as connected branch.
4. Type: Adjustable housing, Heavy-duty, adjustable housing.
5. Body or Ferrule: Cast iron.
6. Clamping Device: Not required.
7. Outlet Connection: Threaded.
8. Closure: Brass plug with straight threads and gasket, Cast-iron plug, Plastic plug.
9. Adjustable Housing Material: Cast iron, Plastic with threads.
10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.

11. Frame and Cover Shape: Round.
12. Top Loading Classification: Extra-Heavy, Light, Medium] Duty.
13. Riser: ASTM A74, Extra-Heavy, Service class, cast-iron drainage pipe fitting and riser to cleanout.

C. Cast-Iron Wall Cleanouts WCO:
1. JR Smith Mfg Co., Josam CO, Watts, Zurn
2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: No-hub, cast-iron soil pipe test tee as required to match connected piping.
5. Closure Plug:
   a. Cast iron.
   b. Countersunk or raised head.
   c. Drilled and threaded for cover attachment screw.
   d. Size: Same as, or not more than, one size smaller than cleanout size.
6. Wall Access, Cover Plate: Round, flat, chrome-plated brass or stainless steel cover plate with screw.
7. Wall Access, Frame and Cover: Round, nickel-bronze, copper-alloy, or stainless steel wall-installation frame and cover.

D. Test Tees:
1. JR Smith Mfg. CO, Josam CO, Watts, Zurn
2. Standard: ASME A112.36.2M and ASTM A74, ASTM A888, or CISPI 301.
3. Size: Same as connected drainage piping.
4. Body Material: Hub-and-spigot, cast-iron soil-pipe T-branch or no-hub, cast-iron soil-pipe test tee as required to match connected piping.
5. Closure Plug: Countersunk or raised head, brass.
6. Closure Plug Size: Same as, or not more than, one size smaller than cleanout size.

2.4 BACKWATER VALVES

A. Cast-Iron, Horizontal Backwater Valves:
1. JR Smith Mfg CO,Josam Co, Watts, Zurn
2. Standard: ASME A112.14.1.
3. Size: Same as connected piping.
4. Body Material: Cast iron.
5. Cover: Cast iron with bolted or threaded access check valve.
6. End Connections: no hub.
7. Check Valve: Removable, bronze, swing check, factory assembled or field modified to hang closed.
8. Extension: ASTM A74, Service class; full-size, cast-iron soil-pipe extension to field-installed cleanout at floor; replaces backwater valve cover.

B. Cast-Iron, Drain-Outlet Backwater Valves :
1. JR Smith, Josam, Watts, Zurn
2. Standard: ASME A112.14.1.
3. Size: Same as floor drain outlet.

4. Body Material: Cast iron or bronze made for vertical installation in bottom outlet of floor drain.
5. Check Valve: Removable ball float.
6. Inlet: Threaded.
7. Outlet: Threaded or spigot.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install roof drains at low points of roof areas in accordance with roof membrane manufacturer's written installation instructions.
   1. Install flashing collar or flange of roof drain to prevent leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
   2. Install expansion joints, if indicated, in roof drain outlets.
   3. Position roof drains for easy access and maintenance.

B. Install downspout adapters on outlet of back-outlet parapet roof drains and connect to sheet metal downspouts.

C. Install downspout boots at grade with top 6 inches above grade. Secure to building wall.

D. Install downspout nozzles at exposed bottom of conductors where they spill onto grade.

E. Install cleanouts in aboveground piping and building drain piping in accordance with the following instructions unless otherwise indicated:
   1. Use cleanouts the same size as drainage piping up to NPS 4. Use NPS 4 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 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
   4. Locate cleanouts at base of each vertical storm piping conductor.

F. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

G. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

H. Install horizontal backwater valves in floor with cover flush with floor.

I. Install drain-outlet backwater valves in outlet of drains.

J. Install test tees in vertical conductors and near floor.

K. Install wall cleanouts in vertical conductors. Install access door in wall if indicated.

L. Install trench drains at low points of surface areas to be drained. Set grates of drains flush with finished surface unless otherwise indicated.

M. Assemble channel drainage system components in accordance with manufacturer's written instructions. Install on support devices so that top will be flush with adjacent surface.

N. Install through-penetration firestop assemblies for penetrations of fire- and smoke-rated assemblies.
   1. Comply with requirements in Section 078413 "Penetration Firestopping."

3.2 CONNECTIONS

A. Comply with requirements for piping specified in Section 221413 "Facility Storm Drainage Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

3.3 INSTALLATION OF FLASHING

A. Fabricate flashing from single piece of metal unless large pans, sumps, or other drainage shapes are required.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

3.4 PROTECTION

A. **Protect drains during remainder** of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

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SECTION 223400

FUEL-FIRED, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Commercial, direct-vent, gas-fired, storage, domestic-water heater.
2. Commercial, gas-fired, high-efficiency, storage, domestic-water heaters.
3. Domestic-water heater accessories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. 50 Gallons**,** recovery GPH @100°F Delta T 138GPH, 120V/1ø, and furnished With Amtrol Model #st-5-c Expansion Tank and accessories**.**

B. Sustainable Design Submittals:

1. <u>AO Smith basis of design.</u>

C. Shop Drawings:

1. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Equipment room drawing or BIM model, drawn to scale, on which the items described in this Section are shown and coordinated with all building trades.

B. Seismic Qualification Data: Certificates, for fuel-fired, domestic-water heaters, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Product Certificates: For each type of commercial, gas-fired**,** domestic-water heater.

D. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

E. Source quality-control reports.

F. Field quality-control reports.

G. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fuel-fired, domestic-water heaters to include in emergency, operation, and maintenance manuals.

1.6 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of fuel-fired, domestic-water heaters that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including storage tank and supports.

b. Faulty operation of controls.

c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Periods: From date of Substantial Completion.

a. Commercial, Gas-Fired, Storage, Domestic-Water Heaters:

1) Storage Tank: Three years.

2) Controls and Other Components: One year(s).

b.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and use.

B. ASHRAE/IES Compliance: Fabricate and label fuel-fired, domestic-water heaters to comply with ASHRAE/IES 90.1.

C. ASME Compliance:

1. Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

2. Where ASME-code construction is indicated, fabricate and label commercial, finned-tube, domestic-water heaters to comply with ASME Boiler and Pressure Vessel Code: Section IV.

D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 and NSF 372.

2.2 COMMERCIAL, GAS-FIRED, STORAGE, DOMESTIC-WATER HEATERS

A. Commercial, Atmospheric, Gas-Fired, Storage, Domestic-Water Heaters:

1. AO Smith Basis of design

2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.

3. Standard: ANSI Z21.10.3/CSA 4.3.

4. Storage-Tank Construction: Non-ASME-code steel with 150-psig working-pressure rating.

a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.

1) NPS 2 and Smaller: Threaded ends in accordance with ASME B1.20.1.

2) NPS 2-1/2 and Larger: Flanged ends in accordance with ASME B16.5 for steel and stainless steel flanges and in accordance with ASME B16.24 for copper and copper-alloy flanges.

b. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.

c. Lining: Cement, Glass or Sheet copper complying with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.

5. Factory-Installed, Storage-Tank Appurtenances:
    a. Anode Rod: Replaceable magnesium.
    b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
    c. Drain Valve: Corrosion-resistant metal with hose-end connection.
    d. Insulation: Comply with ASHRAE/IES 90.1. Surround entire storage tank except connections and controls.
    e. Jacket: Steel with enameled finish.
    f. Burner: For use with atmospheric, gas-fired, domestic-water heaters and natural-gas fuel.
    g. Ignition: Standing pilot or ANSI Z21.20/CSA C22.2 No. 60730-2-5, electric, automatic, gas-ignition system.
    h. Temperature Control: Adjustable thermostat.
    i. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
    j. Combination Temperature-and-Pressure Relief Valves: ANSI Z21.22/CSA 4.4. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select one relief valve with sensing element that extends into storage tank.
6. Special Requirements: NSF 5 construction.
7. Draft Hood: Draft diverter, complying with ANSI Z21.12.
8. Automatic Damper: ANSI Z21.66/CSA 6.14, mechanically activated, automatic-vent-damper device with size matching draft hood.

2.3 DOMESTIC-WATER HEATER ACCESSORIES

A. Domestic-Water Expansion Tanks:
    1. Amtrol basis of design
    2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
    3. Description: Steel, pressure-rated tank constructed with welded joints and factory-installed, butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
    4. Construction:
        a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
        b. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
        c. Air-Charging Valve: Factory installed.
    5. Capacity and Characteristics:
        a. Working-Pressure Rating: 100 psig.
        b. Capacity Acceptable: See Schedule minimum.
        c. Air Precharge Pressure: pre charge pressure.

B. Drain Pans: Corrosion-resistant metal with raised edge. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 with ASME B1.20.1 pipe threads.

C. Piping-Type Heat Traps: Field-fabricated piping arrangement in accordance with ASHRAE/IES 90.1.

D. Heat-Trap Fittings: ASHRAE 90.2.

E. Comply with requirements for ball-, butterfly-, or gate-type shutoff valves specified in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping."

1. Comply with requirements for balancing valves specified in Section 221119 "Domestic Water Piping Specialties."

F. Gas Shutoff Valves: ANSI Z21.15/CSA 9.1, manually operated. Furnish for installation in piping.

G. Gas Pressure Regulators: ANSI Z21.18/CSA 6.3, appliance type. Include 1/2-psig pressure rating as required to match gas supply.

H. Automatic Gas Valves: ANSI Z21.21/CSA 6.5, appliance, electrically operated, on-off automatic valve.

I. Combination Temperature-and-Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valves with sensing element that extends into storage tank.

1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4.

J. Pressure Relief Valves: Include pressure setting less than working-pressure rating of domestic-water heater.

1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4.

K. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4.

L. Domestic-Water Heater Stands: Manufacturer's factory-fabricated steel stand for floor mounting, capable of supporting domestic-water heater and water. Provide dimension that will support bottom of domestic-water heater minimum of 6 inches above the floor.

M. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.

2.4 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect assembled domestic-water heaters and storage tanks specified to be ASME-code construction, in accordance with ASME Boiler and Pressure Vessel Code.

B. Hydrostatically test commercial domestic-water heaters and storage tanks to minimum of one and one-half times pressure rating before shipment.

C. Domestic-water heaters will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

A. Commercial, Domestic-Water Heater Mounting: Install commercial domestic-water heaters on concrete base. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete."

1. Exception: Omit concrete bases for commercial domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.

2. Maintain manufacturer's recommended clearances.

3. Arrange units so controls and devices that require servicing are accessible.

4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.

5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.

6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

7. Install anchor bolts to elevations required for proper attachment to supported equipment.
8. Anchor domestic-water heaters to substrate.

B. Install domestic-water heaters level and plumb, in accordance with layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping."

C. Install gas-fired, domestic-water heaters in accordance with NFPA 54.

1. Install gas shutoff valves on gas supply piping to gas-fired, domestic-water heaters without shutoff valves.
2. Install gas pressure regulators on gas supplies to gas-fired, domestic-water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
3. Install automatic gas valves on gas supplies to gas-fired, domestic-water heaters if required for operation of safety control.
4. Comply with requirements for gas shutoff valves, gas pressure regulators, and automatic gas valves specified in Section 231123 "Facility Natural-Gas Piping”.

D. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend domestic-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

E. Install combination temperature-and-pressure relief valves in water piping for domestic-water heaters without storage. Extend domestic-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

F. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 221119 "Domestic Water Piping Specialties."

G. Install thermometer on outlet piping of domestic-water heaters. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

H. Assemble and install inlet and outlet piping manifold kits for multiple domestic-water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each domestic-water heater. Include shutoff valve and thermometer in each domestic-water heater inlet and outlet, and throttling valve in each domestic-water heater outlet. Comply with requirements for valves specified in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping," and comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

I. Install piping-type heat traps on inlet and outlet piping of domestic-water heater storage tanks without integral or fitting-type heat traps.

J. Fill domestic-water heaters with water.

K. Charge domestic-water expansion tanks with air to required system pressure.

L. Install dielectric fittings in all locations where piping of dissimilar metals is to be joined. The wetted surface of the dielectric fitting contacted by potable water shall contain less than 0.25 percent of lead by weight.

3.2 PIPING CONNECTIONS

A. Comply with requirements for domestic-water piping specified in Section 221116 "Domestic Water Piping."

B. Comply with requirements for fuel-oil piping specified in Section 231113 "Facility Fuel-Oil Piping."

C. Comply with requirements for gas piping specified in Section 231123 "Facility Natural-Gas Piping."

D. Drawings indicate general arrangement of piping, fittings, and specialties.

E. Where installing piping adjacent to fuel-fired, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

D. Perform tests and inspections.

E. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

F. Domestic-water heaters will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports.

3.5 DEMONSTRATION

A. Owner's maintenance personnel to adjust, operate, and maintain commercial, gas-fired, storage, domestic-water heaters.

END OF SECTION

SECTION 224213.13
COMMERCIAL WATER CLOSETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Wall-mounted water closets.
2. Flushometer valves.
3. Toilet seats.
4. Supports.

1.3 DEFINITIONS

A. Effective Flush Volume: Average of two reduced flushes and one full flush per fixture.

B. Remote Water Closet: Located more than 30 feet from other drain line connections or fixture and where less than 1.5 drainage fixture units are upstream of the drain line connection.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for water closets.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Sustainable Design Submittals:

1. Kohler, American Standard, Zurn, Toto

C. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flushometer valves and electronic sensors to include in operation and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that are packaged with protective covering for storage and identified with labels describing contents.

1. Flushometer-Valve Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than one of each type.

PART 2 - PRODUCTS

2.1 WALL-MOUNTED WATER CLOSETS

A. Water Closets, Wall Mounted, Top Spud**,** Accessible:

1. American Standard, Kohler, CO, Sloan, Zurn, Toto
2. Bowl:
   a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
   b. Material: Vitreous china.
   c. Type: Siphon jet.
   d. Style: Flushometer valve.

e. Height: Standard.

f. Rim Contour: Elongated.

g. Water Consumption: 1.28 gal.-1.6 gal. per flush.

h. Spud Size and Location: NPS 1-1/2; top.

3. Flushometer Valve: Sloanbasis of design.

4. Toilet Seat: Kohler basis of design.

5. Support: Zurn.

6. Water-Closet Mounting Height: Standard, Handicapped/elderly according to ICC/ANSI A117.1.

B. Water Closets, Wall Mounted, Top Spud, Accessible:

1. American Standard, Kohler, Sloan, Toto, Zurn

2. Bowl:

a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.

b. Material: Vitreous china.

c. Type: Siphon jet.

d. Style: Flushometer valve.

e. Height: Standard.

f. Rim Contour: Elongated.

g. Water Consumption: 1.28 gal. to 1.6 gal. per flush.

h. Spud Size and Location: NPS 1-1/2; back.

3. Flushometer Valve: Sloan basis of design.

4. Toilet Seat: Kohler basis of design.

5. Support: Water closet carrier Zurn basis of design.

6. Water-Closet Mounting Height: Standard and Handicapped/elderly according to ICC A117.1.

2.2 FLUSHOMETER VALVES

A. Lever-Handle, Diaphragm Flushometer Valves:

1. Sloan, Kohler, Zurn

2. Standard: ASSE 1037.

3. Minimum Pressure Rating: 125 psig.

4. Features: Include integral check stop and backflow-prevention device.

5. Material: Brass body with corrosion-resistant components.

6. Exposed Flushometer-Valve Finish: Chrome plated.

7. Panel Finish: Chrome plated or stainless steel.

8. Style: Exposed.

9. Consumption: 1.28 gal. to 1.6 gal. per flush.

10. Minimum Inlet: NPS 1.

11. Minimum Outlet: NPS 1-1/4.

B. Battery-Powered, Solenoid-Actuator, Piston Flushometer Valves:

1. Sloan, Kohler, Zurn

2. Standard: ASSE 1037.

3. Minimum Pressure Rating: 125 psig.
4. Features: Include integral check stop and backflow-prevention device.
5. Material: Brass body with corrosion-resistant components.
6. Exposed Flushometer-Valve Finish: Chrome plated.
7. Panel Finish: Chrome plated or stainless steel.
8. Style: Exposed.
9. Actuator: Solenoid complying with UL 1951, and listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
10. Trip Mechanism: Battery-powered electronic sensor complying with UL 1951, and listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
11. Consumption: 1.28 gal**.** to 1.6 gal. per flush.
12. Minimum Inlet: NPS 1.
13. Minimum Outlet: NPS 1-1/4.

2.3 TOILET SEATS

A. Toilet Seats :

1. Kohler basis of design
2. Standard: IAPMO/ANSI Z124.5.
3. Material: Plastic.
4. Type: Commercial (Standard) and Commercial (Heavy duty).
5. Shape: Elongated rim, open front.
6. Hinge: Check.
7. Hinge Material: Noncorroding metal.
8. Seat Cover: Not required.
9. Color: See Arch otherwise White.

2.4 SUPPORTS

A. Water Closet Carrier:

1. Zurn basic of design
2. Standard: ASME A112.6.1M.
3. Description: Waste-fitting assembly, as required to match drainage piping material and arrangement with faceplates, couplings gaskets, and feet; bolts and hardware matching fixture.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before water-closet installation.

B. Examine walls and floors for suitable conditions where water closets will be installed.

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

3.2 INSTALLATION, GENERAL

A. Water-Closet Installation:

1. Install level and plumb according to roughing-in drawings.
2. Install floor-mounted water closets on bowl-to-drain connecting fitting attachments to piping or building substrate.

3. Install accessible, wall-mounted water closets at mounting height for handicapped/elderly, according to ICC/ANSI A117.1.

B. Support Installation:

1. Install supports, affixed to building substrate, for floor-mounted, back-outlet water closets.
2. Use carrier supports with waste-fitting assembly and seal.
3. Install floor-mounted, back-outlet water closets attached to building floor substrate, onto waste-fitting seals; and attach to support.
4. Install wall-mounted, back-outlet water-closet supports with waste-fitting assembly and waste-fitting seals; and affix to building substrate.

C. Flushometer-Valve Installation:

1. Install flushometer-valve, water-supply fitting on each supply to each water closet.
2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
3. Install lever-handle flushometer valves for accessible water closets with handle mounted on open side of water closet.
4. Install actuators in locations that are easy for people with disabilities to reach.
5. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

D. Install toilet seats on water closets.

E. Wall Flange and Escutcheon Installation:

1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.
3. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

F. Joint Sealing:

1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to water-closet color.
3. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.3 CONNECTIONS

A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

D. Where installing piping adjacent to water closets, allow space for service and maintenance.

3.4 ADJUSTING

A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.

B. Adjust water pressure at flushometer valves to produce proper flow.

C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

A. Clean water closets and fittings with manufacturers' recommended cleaning methods and materials.

B. Install protective covering for installed water closets and fittings.

C. Do not allow use of water closets for temporary facilities unless approved in writing by Owner.

END OF SECTION

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SECTION 224213.16

COMMERCIAL URINALS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Urinals.
2. Flushometer valves.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flushometer valves to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 WALL-HUNG URINALS

A. Urinals P-3 & P-4: Wall hung, back outlet, washout, P-4 - accessible.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. American Standard.
   b. Crane Plumbing, L.L.C.
   c. Kohler Co.
   d. TOTO USA, INC.
2. Fixture:
   a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
   b. Material: Vitreous china.
   c. Type: Washout with extended shields.
   d. Strainer or Trapway: Manufacturer's standard strainer with integral trap.
   e. Water Consumption: Water saving.
   f. Spud Size and Location: NPS 3/4, top.
   g. Outlet Size and Location: NPS 2, back.
   h. Color: White.
3. Flushometer Valve: Manual with key, see schedule on drawing.
4. Waste Fitting:
   a. Standard: ASME A112.18.2/CSA B125.2 for coupling.
   b. Size: NPS 2.
5. Support: Type I Urinal Carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture. Include rectangular, steel uprights..
6. Urinal Mounting Height: P-3 – Standard; P-4 - Handicapped/elderly according to ICC A117.1.

2.2 URINAL FLUSHOMETER VALVES

A. Lever-Handle, Diaphragm Flushometer Valves, P-3 & P-4:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. Sloan Valve Company.
2. Standard: ASSE 1037.
3. Minimum Pressure Rating: 125 psig.
4. Features: Include integral check stop and backflow-prevention device.
5. Material: Brass body with corrosion-resistant components.
6. Exposed Flushometer-Valve Finish: Chrome plated.
7. Style: Exposed.
8. Consumption: 1.0 gal. per flush.
9. Minimum Inlet: NPS 3/4.
10. Minimum Outlet: NPS 1-1/4.

2.3 SUPPORTS

A. Type I Urinal Carrier:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Jay R. Smith Mfg. Co.
   b. Josam Company.
   c. Wade Drains.
   d. WATTS.
2. Standard: ASME A112.6.1M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before urinal installation.

B. Examine walls and floors for suitable conditions where urinals will be installed.

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

3.2 INSTALLATION

A. Urinal Installation:

1. Install urinals level and plumb according to roughing-in drawings.
2. Install wall-hung, back-outlet urinals onto waste fitting seals and attached to supports.
3. Install wall-hung, bottom-outlet urinals with tubular waste piping attached to supports.
4. Install accessible, wall-mounted urinals at mounting height for the handicapped/elderly, according to ICC/ANSI A117.1.
5. Install trap-seal liquid in waterless urinals.

B. Support Installation:

1. Install supports, affixed to building substrate, for wall-hung urinals.
2. Use off-floor carriers with waste fitting and seal for back-outlet urinals.
3. Use carriers without waste fitting for urinals with tubular waste piping.
4. Use chair-type carrier supports with rectangular steel uprights for accessible urinals.

C. Flushometer-Valve Installation:

1. Install flushometer-valve water-supply fitting on each supply to each urinal.
2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
3. Install lever-handle flushometer valves for accessible urinals with handle mounted on open side of compartment.
4. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

D. Wall Flange and Escutcheon Installation:

1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.
3. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

E. Joint Sealing:

1. Seal joints between urinals and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to urinal color.
3. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.3 CONNECTIONS

A. Connect urinals with water supplies and soil, waste, and vent piping. Use size fittings required to match urinals.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

D. Where installing piping adjacent to urinals, allow space for service and maintenance.

3.4 ADJUSTING

A. Operate and adjust urinals and controls. Replace damaged and malfunctioning urinals, fittings, and controls.

B. Adjust water pressure at flushometer valves to produce proper flow.

C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

A. Clean urinals and fittings with manufacturers' recommended cleaning methods and materials.

B. Install protective covering for installed urinals and fittings.

C. Do not allow use of urinals for temporary facilities unless approved in writing by Owner.

END OF SECTION

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SECTION 224216.13
COMMERCIAL LAVATORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Lavatories.
2. Faucets.
3. Supports.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include diagrams for power, signal, and control wiring of automatic faucets.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lavatories and faucets to include in operation and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. Servicing and adjustments of automatic faucets.

PART 2 - PRODUCTS

2.1 VITREOUS-CHINA, WALL-MOUNTED LAVATORIES

A. Lavatory, P-2: Vitreous china, wall mounted, with back.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. TOTO USA.

2. Fixture:

a. Standard: ASME A112.19.2/CSA B45.1.

b. Type: For wall hanging.

c. Nominal Size: 20 by 19 inches.

d. Faucet-Hole Punching: One hole.

e. Faucet-Hole Location: Top.

f. Color: White.

g. Mounting Material: Chair carrier.

3. Faucet: Sensor, see schedule on drawing .

4. Support: Type II, concealed-arm lavatory carrier. Include rectangular, steel uprights.

5. Lavatory Mounting Height: P-15 – Standard; P-5 - Handicapped/elderly according to ICC A117.1.

2.2 SUPPORTS

A. Type II Lavatory Carrier:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Jay R. Smith Mfg. Co.

b. Josam Company.

c. Wade Drains.

d. WATTS.

2. Standard: ASME A112.6.1M.

2.3 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless-steel wall flange.

D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

E. Operation: Loose key.

F. Risers:

1. NPS 1/2.

2. ASME A112.18.6, braided- or corrugated-stainless-steel, flexible hose riser.

2.4 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Drain: Grid type with NPS 1-1/4 offset and straight tailpiece.

C. Trap:

1. Size: NPS 1-1/2 by NPS 1-1/4.

2. Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch-thick brass tube to wall; and chrome-plated, brass or steel wall flange.

3. Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch-thick stainless-steel tube to wall; and stainless-steel wall flange.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before lavatory installation.

B. Examine counters and walls for suitable conditions where lavatories will be installed.

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

3.2 INSTALLATION

A. Install lavatories level and plumb according to roughing-in drawings.

B. Install supports, affixed to building substrate, for wall-mounted lavatories.

C. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, according to ICC/ANSI A117.1.

D. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

E. Seal joints between lavatories and counters and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

3.3 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

A. After completing installation of lavatories, inspect and repair damaged finishes.

B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed lavatories and fittings.

D. Do not allow use of lavatories for temporary facilities unless approved in writing by Owner.

END OF SECTION

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SECTION 224216.16
COMMERCIAL SINKS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Service basins.
2. Sink faucets.
3. Supports.
4. Supply fittings.
5. Waste fittings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

PART 2 - PRODUCTS

2.1 SERVICE BASINS

A. Service Basins, P-4: Terrazzo, floor mounted.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Fiat.
   b. Florestone
   c. Stern Williams
2. Fixture:
   a. Standard: IAPMO/ANSI Z124.6.
   b. Material: Terrazzo .
   c. Nominal Size: 24 by 24 by 12 inches.
   d. Tiling Flange: Not required.
   e. Rim Guard: On front top surfaces.
   f. Color: Not applicable.
   g. Drain: Grid with NPS 3 outlet.
3. Mounting: On floor and flush to wall.
4. Faucet: See schedule on drawing .

2.2 SINK FAUCETS

A. NSF Standard: Comply with NSF 372 for faucet-spout materials that will be in contact with potable water.

B. Sink Faucets: See schedule on drawing.

2.3 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF 372 for supply-fitting materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Supply Piping: Chrome-plated brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated brass or stainless-steel wall flange.

D. Supply Stops: Chrome-plated brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

E. Operation: Loose key.

F. Risers:

1. NPS 1/2.

2. ASME A112.18.6, braided or corrugated stainless-steel flexible hose.

2.4 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Drain: Grid type with NPS 1-1/2 offset and straight tailpiece.

C. Trap:

1. Size: NPS 2.

2. Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch-thick brass tube to wall; and chrome-plated brass or steel wall flange.

3. Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch-thick stainless-steel tube to wall; and stainless-steel wall flange.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before sink installation.

B. Examine walls, floors, and counters for suitable conditions where sinks will be installed.

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

3.2 INSTALLATION

A. Install sinks level and plumb according to roughing-in drawings.

B. Install supports, affixed to building substrate, for wall-hung sinks.

C. Install accessible wall-mounted sinks at handicapped/elderly mounting height according to ICC/ANSI A117.1.

D. Set floor-mounted sinks in leveling bed of cement grout.

E. Install water-supply piping with stop on each supply to each sink faucet.

1. Exception: Use ball or gate valves if supply stops are not specified with sink. Comply with valve requirements specified in Section 220523.12 "Ball Valves for Plumbing Piping" and Section 220523.15 "Gate Valves for Plumbing Piping."

2. Install stops in locations where they can be easily reached for operation.

F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

G. Seal joints between sinks and counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

H. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

3.3 CONNECTIONS

A. Connect sinks with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Operate and adjust sinks and controls. Replace damaged and malfunctioning sinks, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

3.5 CLEANING AND PROTECTION

A. After completing installation of sinks, inspect and repair damaged finishes.

B. Clean sinks, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed sinks and fittings.

D. Do not allow use of sinks for temporary facilities unless approved in writing by Owner.

END OF SECTION

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SECTION 224716
PRESSURE WATER COOLERS

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 pressure water coolers and related components.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of pressure water cooler.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Sustainable Design Submittals:

1. Elkay, Haws

C. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For pressure water coolers to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filter Cartridges: Equal to 100 percent of quantity installed for each type and size indicated, but no fewer than 1 of each.

PART 2 - PRODUCTS

2.1 PRESSURE WATER COOLERS

A. Pressure Water Coolers P-7 Flush to wall.

1. Elkay, Haws
2. Standards:
   a. Comply with NSF 61 and NSF 372.
   b. Comply with ASHRAE 34, "Designation and Safety Classification of Refrigerants," for water coolers. Provide HFC 134a (tetrafluoroethane) refrigerant unless otherwise indicated.
3. Cabinet: Vinyl-covered steel with stainless-steel top.
4. Bubbler: One, with adjustable stream regulator, located on deck.
5. Control: Push button.
6. Drain: Grid with NPS 1-1/4 tailpiece.
7. Supply: NPS 3/8 with shutoff valve.
8. Waste Fitting: ASME A112.18.2/CSA B125.2, NPS 1-1/4 brass P-trap.
9. Filter: One or more water filters complying with NSF 42 and NSF 53 for cyst and lead reduction to below EPA standards, with capacity sized for unit peak flow rate.

10. Cooling System: Electric, with hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.
    a. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
11. Capacities and Characteristics:
    a. Cooled Water: 5 gph.
    b. Ambient-Air Temperature: 90 deg F.
    c. Inlet-Water Temperature: 80 deg F.
    d. Cooled-Water Temperature: 50 deg F.
    e. Electrical Characteristics:
        1) Motor Horsepower: 1/6.
        2) Volts: 120-V ac.
        3) Phase: Single.
        4) Hertz: 60.
        5) Full-Load Amperes: 5.
        6) Minimum Circuit Ampacity:
        7) Maximum Overcurrent Protection: .

B. Pressure Water Coolers P-7: Wall mounted, standard, wheelchair accessible, bottle filler, vandal resistant.
1. Elkay, Haws
2. Standards:
    a. Comply with NSF 61 and NSF 372.
    b. Comply with ASHRAE 34, "Designation and Safety Classification of Refrigerants," for water coolers. Provide HFC 134a (tetrafluoroethane) refrigerant unless otherwise indicated.
    c. Comply with ICC A117.1.
3. Cabinet: Single vinyl-covered steel with stainless-steel top.
4. Bubbler: One, with adjustable stream regulator, located on each cabinet deck.
5. Control: Push button.
6. Bottle Filler: Sensor activation with 20-second automatic shutoff timer. Fill rate 0.5 to 1.5 gpm.
7. Drain: Grid with NPS 1-1/4 tailpiece.
8. Supply: NPS 3/8 with shutoff valve.
9. Waste Fitting: ASME A112.18.2/CSA B125.2, NPS 1-1/4 brass P-trap.
10. Filter: One or more water filters complying with NSF 42 and NSF 53 for cyst and lead reduction to below EPA standards; with capacity sized for unit peak flow rate.
11. Cooling System: Electric, with hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.
    a. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

12. Capacities and Characteristics:
    a. Cooled Water: 5 gph.
    b. Ambient-Air Temperature: 90 deg F.
    c. Inlet-Water Temperature: 80 deg F.
    d. Cooled-Water Temperature: 50 deg F.
    e. Electrical Characteristics:
        1) Motor Horsepower: 1/6.
        2) Volts: 120-V ac.
        3) Phase: Single.
        4) Hertz: 60.
        5) Full-Load Amperes: 5.
        6) Minimum Circuit Ampacity: 5 amperage.
        7) Maximum Overcurrent Protection: 5 amperage.
13. Support: Type I Water Cooler Carrier.
14. Water Cooler Mounting Height: Handicapped/elderly according to ICC A117.

2.2 SUPPORTS

A. Type I Water Cooler Carrier:
    1. Zurn, Watts, JR Smith or Josam
    2. Standard: ASME A112.6.1M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before fixture installation.

B. Examine walls and floors for suitable conditions where fixtures will be installed.

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

3.2 INSTALLATION

A. Install fixtures level and plumb according to roughing-in drawings. For fixtures indicated for children, install at height required by authorities having jurisdiction.

B. Set freestanding pressure water coolers on floor.

C. Install off-the-floor carrier supports, affixed to building substrate, for wall-mounted fixtures.

D. Install mounting frames, affixed to building construction, and attach recessed, pressure water coolers, and in-wall bottle filling stations to mounting frames.

E. Install water-supply piping with shutoff valve on supply to each fixture to be connected to domestic-water distribution piping. Use ball or gate valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Section 220523.12 "Ball Valves for Plumbing Piping" and Section 220523.15 "Gate Valves for Plumbing Piping."

F. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.

G. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

H. Seal joints between fixtures and walls using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.3 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Install ball or gate shutoff valve on water supply to each fixture. Install valve upstream from filter for water cooler. Comply with valve requirements specified in Section 220523.12 "Ball Valves for Plumbing Piping" and Section 220523.15 "Gate Valves for Plumbing Piping."

D. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Adjust fixture flow regulators for proper flow and stream height.

B. Adjust pressure water-cooler temperature settings.

3.5 CLEANING

A. After installing fixture, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.

C. Provide protective covering for installed fixtures.

D. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 230000

GENERAL REQUIREMENTS FOR MECHANICAL TRADES

PART 1 - GENERAL

1.1 GENERAL

A. Applicable portions of all documents listed in the index apply to work of this section.

B. Provisions stated in this section are applicable to all sections of the Division 23 Mechanical Specifications and to all phases of the Mechanical work shown on the drawings.

C. The "Materials and Equipment" paragraph of this section shall take precedence over all related provisions of Division 1 Section, which may conflict with this section.

1.2 SINGULAR NUMBER

A. In all cases where a device or piece of equipment is herein referred to in the singular, such reference shall apply to as many such items as are required to complete the installation. Quantity determinations of all materials and equipment shall be the complete responsibility of the Contractor.

1.3 DEFINITIONS

A. The following are definitions of terms and expressions used throughout division 23 specifications:

1. Owner - Rockland Green MRF Facility
2. Architect - RRT
3. Engineer - Martin Rogers Associates, P.C.
4. A/E - Architect or Engineer
5. Provide - Furnish and install.
6. Work - Plant, labor, and material.
7. Directed - Directed by the A/E.
8. Indicated - Indicated by the contract documents
9. Concealed - Hidden from sight; includes items in shafts, pipe and duct spaces, and above ceilings.
10. Exposed - Not concealed; work within equipment rooms and exposed to view by the occupant shall be considered exposed.
11. Ductwork - Includes ducts, fittings, housings, plenums, dampers, hangers, and accessories comprising a system.
12. ATC - Automatic Temperature Control.
13. DDC - Direct Digital Control.
14. HVAC - Heating, Ventilating, and Air-conditioning.

1.4 SCOPE OF WORK

A. This Section includes general administrative procedures and requirements for mechanical installations, as well as basic materials and methods of construction for the installation of mechanical systems.

B. The following administrative procedures and requirements are included in this section to expand and supplement the requirements specified in the front end of this specification:

1. Work included
2. Work excluded
3. Intent of drawings
4. Contract drawings

5. Coordination drawings
6. Record drawings
7. Codes, permits, approvals
8. Inspections
9. Materials and equipment
10. Source of supply List
11. Submittals/shop drawings
12. Contractor's responsibilities - submittals
13. Substitution of materials and equipment
14. Service agencies
15. Performance of equipment
16. Guaranty/warranty
17. Operating and maintenance manuals
18. Charts
19. Temporary Heat

C. The following basic materials and methods of construction for the installation of mechanical systems are included in this section:

1. Vibration Control
2. Accessibility
3. Examination of site
4. Dimension of existing structures
5. Lines, grades, and measurements
6. Coordination
7. Delivery, storage, and handling
8. Protection
9. Cutting and patching
10. Equipment installation and connections
11. Mounting mechanical devices in suspended ceilings

1.5 WORK INCLUDED

A. Work under Division 23 of the specifications of the contract shall include all plant, labor, and material required to complete the work as shown on the drawings, hereinafter specified, or both. Work of this contract shall include but not be limited to the items outlined in each of the Division 23 sections herein. Work generally includes:

1. Mechanical (HVAC):
   - Miscellaneous general construction as noted.
   - Rooftop HVAC units.
   - Rooftop Exhaust fans.
   - Infrared tube heaters.
   - Gas fired unit heaters.
   - Supply VAV boxes with electric reheat coils, controls, and accessories.
   - Hangers, supports, and equipment pads as specified and required.
   - Thermal insulation as specified and required.

- Ductless split systems for IT closet.
- Ductwork, dampers, and related sheet metal work as noted and required.
- Smoke and fire dampers through rated assemblies per the architectural life safety plan.
- Ceiling and wall diffusers, grilles, and louvers as indicated.
- New Building Management System.
- Coordination of ceiling heights and clearances with General and Electrical Contractors necessary to accomplish effective HVAC in harmony with the architectural design.
- Coordination of sizes, weights, roof openings, roof curb requirements, and floor and wall openings of mechanical equipment with General Contractor.
- Factory start-up for all major HVAC equipment.
- Testing, adjusting, and balancing of all work installed.
- Owner training on operation and maintenance of all systems and equipment.

1.6 WORK EXCLUDED

A. All work shown or specified shall be included in the Contract unless specifically mentioned herein.

1.7 INTENT OF DRAWINGS

A. The Contractor generally responsible for the trade of a specific drawing shall provide all work indicated on that drawing unless explicitly indicated otherwise. For example:

1. M-# drawings - Mechanical/HVAC Contractor
2. P-# drawings - Plumbing Contractor
3. FP-# drawings - Fire Protection Contractor

B. Work may include items that may relate to other major trades. Specifically, all work indicated on the "M" drawings (Mechanical/HVAC) shall be provided by the Mechanical/HVAC Contractor unless specifically indicated to be provided by others. The same principle shall apply to "P" drawings (Plumbing), and “FP” (Fire Protection) drawings.

1.8 CONTRACT DRAWINGS

A. Drawings that constitute a part of this contract indicate the general arrangement of piping, ductwork, accessories, equipment, and other work. It is the intent of these drawings and specifications to describe a complete and integrated system. It is understood that while the drawings may not show every pipe, valve, damper, and detail, all equipment and accessories that are reasonably inferable from the drawings and specifications as being necessary for the completion and proper performance of the work shall be included even though not specifically mentioned. What is called for on either the drawings or in the specifications shall be as binding as if called for on both.

B. It is understood that while the drawings shall be followed as closely as circumstances will permit, the Contractor is held responsible for the proper installation of materials and equipment to the true intent and meaning of plans and specifications. If any equipment, piping, or ductwork cannot be installed as shown, the Contractor shall consult with the A/E before making any changes.

1.9 COORDINATION DRAWINGS

A. The contractor shall prepare coordination drawings for the building. Drawings shall be coordinated among all trades and shall be generated in Revit.

B. Coordination drawings shall be prepared to a scale of 1/4”=1’-0” or larger, detailing major elements, components, and systems of mechanical equipment and materials in relationship to other systems, installations and building components.

C. Coordination drawings shall include plans of each area and sections of congested area.

D. Coordination drawings shall:

1. Indicate the proposed locations of any piping, ductwork, equipment and materials relating to the following:

   a. Equipment pads and bases

   b. Clearances for installing, servicing, and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.

   c. Equipment service connections and support details.

   d. Ceiling plenums, chases, shafts, trenches, and other tight and congested spaces.

   e. Duct system layout, include elbows, radii, and accessories.

2. Indicate the proposed scheduling, sequencing, movement, and positioning of large equipment into the building during construction.

3. Include floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

4. Include reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communication systems components, sprinklers, and other ceiling-mounted items.

1.10 RECORD DRAWINGS

A. During construction, the Contractor shall maintain a record set of contract drawings and shall record on this set in colored pencil all deviations from the original in pipe, duct, or equipment sizes, locations, and other pertinent details.

B. Upon completion of the work, Contractor shall forward these marked prints to the Architect/Engineer for review.

1.11 CODES, PERMITS, APPROVALS

A. All required local, state and utility company permits and approvals shall be applied for and paid for by this Contractor.

B. All persons digging at the site shall notify DIG SAFELY NEW YORK ONE CALL at 1-800-962-7962.

C. All Mechanical/HVAC work shall comply with all applicable provisions of the International Building Codes (IBC), latest edition, including the International Mechanical Code (IMC).

D. All Mechanical/HVAC work shall be subject to all provisions of the National Fire Code, including NFPA-90a and 90b.

E. All work shall meet the requirements and standards of the several Utility Company(s) serving the project. Install and test backflow preventers in accordance with regulations of the serving utility company.

F. All materials furnished shall meet the ASTM Specifications latest revisions.

G. Products furnished under this contract shall comply with the Pennsylvania “Steel Product Procurement Act, of 1978, P.L.6, Number 3” including the 1984 and all subsequent amendments.

H. All electrical work shall be in conformance with the latest edition of the National Electrical Code (NEC).

I. In all cases, the local Authority-Having-Jurisdiction (AHJ) has the right to impose a higher standard of care than the basic codes listed herein. The contractor shall be familiar with the requirements of and, if unsure, consult with the local AHJ, and make due allowance for more stringent stipulations if necessary. The contractor shall be responsible for all additional work and related costs to comply with the requirements of the local AHJ where such requirements differ from those listed in the basic building code(s).

1.12 MATERIALS AND EQUIPMENT

A. All materials and equipment shall be new, the best of their respective kinds, and suitable for the conditions and duties imposed on them at the building. The description, characteristics, and requirements of materials to be used shall be in accordance with qualifying conditions established in the following sections.

B. All component parts of each item of equipment or device shall bear the manufacturer's nameplate, giving name of manufacturer, description, size, type, serial or model number, electrical characteristics, and any other imperative information to facilitate their maintenance or replacement. The nameplate of a subcontractor or distributor will not be acceptable.

C. All equipment requiring electrical service shall be UL labeled. If a UL label is not available from the manufacturer, when requested or required by the local authority having jurisdiction, the equipment shall be tested by an approved electrical testing company in accordance with NEC, and at no additional cost to the owner. Submit data indicating compliance with standards prior to installation.

D In specifying materials, four general groups are used and defined as follows:

1. GROUP 1: When the material or equipment is specified:

   a) "make and model as scheduled on the drawings", or

   b) by brand name or other identifying information,

   and <u>one name brand only is used</u>, it is considered that the use of that particular item is essential to the project, and <u>the Contractor shall base their proposal on the cost of that item.</u>

2. GROUP 2: When the material or equipment is specified:

   a) "make and model as scheduled on the drawings", or

   b) by brand name and other identifying information,

and <u>two or more brand names are given</u>, it is considered that the first brand name specified or scheduled is the basis of design but that equivalent models of any one of the brands so named are acceptable - in terms of performance -, and the Contractor shall base their proposal on one of the named brands. Equivalent models shall be like the first brand name specified in all respects, including but not limited to size, appearance, and operation.

3. GROUP 3: When the material or equipment is specified:

   a) "make and model as scheduled on the drawings", or

   b) by brand name and other identifying information,

<u>with the phrase ".... or approved equivalent</u>", it is intended that the brand name used is for establishing a minimum acceptable standard of quality and performance and the Contractor may base his bid proposal on any item which is in all respects equivalent or superior to that specified and presents similar appearance, operation, and performance.

4. GROUP 4: When material is specified as complying with the requirements of published "Standard Specification" of trade associations, American Society for Testing and Materials (ASTM), government specifications, etc., the Contractor's proposal may be based on any item which can be shown to comply in all respects with the referred "Standard Specification".

E. The contractor understands that:

1. The A/E will use their own judgment in determining if any materials, equipment or methods offered for review as an equivalent are equivalent to those specified and will fit the space available;
2. The decision of the A/E on all such questions of equivalency is final;
3. Any acceptable material, equipment, and methods will be provided <u>at no increases in cost to the owner.</u>

1.13 SOURCE OF SUPPLY LIST

A. Within 21 days after award of contract, the contractor shall submit to the A/E for review a list of manufacturer's names of material and equipment he proposes to provide. In the event any item of material or equipment contained in the list fails to comply with the specification requirements, such item will be rejected. If, prior to the expiration of the 21-day period, or any duly authorized extension thereof, the Contractor fails to submit a schedule of acceptable material or equipment, the A/E will select the items; such selection shall be final and binding upon the Contractor as condition of the contract. Rejected items shall be resubmitted within 21 days or the A/E will select such materials and equipment.

1.14 SUBMITTALS AND SHOP DRAWINGS

A. After receiving approval of the source of supply list; furnish catalog data, dimensional data, performance specifications, etc., in sufficient detail to properly identify and judge each item. Each item or equipment proposed shall be a standard product of the approved manufacturer.

B. Samples, drawings, specifications, catalogs, etc., submitted for review shall be dated, properly labeled indicating specific service for which material or equipment is to be used, section and article number of specifications governing, Contractor's name, and name of job.

C. Review of shop drawings or samples by the Engineer shall not relieve the Contractor of responsibility for any deviation from the requirements of the contract documents. Deviations from the contract documents will only be allowed if all the following are satisfied:

- The Contractor has informed the Engineer in writing of all deviations at the time of submission,
- The Contractor has noted the deviation on the shop drawings,
- The Engineer has acknowledged, in writing, the specific deviation.

D. In any event, the Engineer's review shall not relieve the Contractor from responsibility for errors or omissions in the shop drawings or samples.

E. No materials or equipment shall be purchased, delivered to the site, or installed until they have been reviewed by the A/E. Review of any submittal shall not relieve the Contractor of responsibility for deviation from the drawings or specifications, nor shall it relieve the Contractor from errors in the submittals. Dimensions and quantities shall, in all cases, be the complete responsibility of the Contractor.

F. After the A/E's review of a submittal, it shall be marked with one or more comments as defined below:

- <u>No Exceptions Taken:</u> The contractor may proceed using the reviewed material,
- <u>Note Markings:</u> The contractor may proceed using the reviewed material provided corrective action is taken on all comments noted on the submittal,
- <u>Comments Attached:</u> Same as "Note Markings", except that, comments have been noted on a supplemental attachment,
- <u>Contractor Confirm:</u> The contractor shall respond in writing to all comments including confirmation that corrective action will be taken on all comments noted prior to proceeding with the work,

- Resubmit: The contractor shall respond to all comments noted, revise shop drawings accordingly, and resubmit for review,
- Rejected: The proposed material or equipment does not comply with the requirements of the contract documents and may not be used for this project.

G. Upon receipt of written notice from the A/E that the material, equipment, or methods have been reviewed and marked “no exceptions taken”, “Note Markings”, or “Comments Attached”, the Contractor may proceed with the reviewed material, equipment, or methods. The Contractor assumes full responsibility for and shall make, at no expense to the owner, all changes or adjustments in construction that may result using such approved materials, equipment or methods, including electrical and other services provided under other divisions of this specification. In the event of any adverse decisions by the A/E, no claim of any sort shall be made or allowed against the A/E or the owner.

H. If material or equipment is installed prior to receipt by the contractor of submittals marked “no exceptions taken”, “note markings”, or “comments attached”, the Contractor shall be liable for its removal and replacement at no extra cost to the Owner.

I. Sufficient sets shall be submitted to allow two (2) copies to be retained by the A/E.

J. Materials and equipment requiring submittals are listed in each section of these specifications.

1.15 CONTRACTORS RESPONSIBILITY - SUBMITTALS

A. The Contractor shall submit a letter with each submittal forwarded to the Architect/Engineer's office for review certifying that they have personally reviewed the material submitted and found it to be satisfactory for this project. This certification shall cover dimensional checking as well as cross checking with the Architectural, Mechanical, and/or Electrical documents to ensure that no changes will be required in other contracts.

B. Any material submitted to the Engineer's office without this Contractor's certification will be returned without action.

C. Whenever alternate equipment is submitted, it shall be accompanied by a 1/4" - 1'0" scale drawing of the mechanical equipment room showing the alternate equipment, all clearances, etc. Submittals without this information will be returned without review or comment.

1.16 SUBSTITUTION OF EQUIPMENT

A. Substitution of equipment of makes other than those specified, after receipt of the bid, will be approved by the A/E only if:

- The equipment proposed for substitution is equivalent or superior to equipment named in terms of construction, efficiency, and utility, and
- That the equipment named in the specifications cannot be delivered to the job in time to complete the work in proper sequence to work of other Contractors, due to conditions beyond control of the Contractor.

B. To receive consideration, requests for substitutions must be accompanied by documentary proof of equivalence or difference in price and delivery, if any, in form of certified quotations from suppliers of both specified and proposed equipment.

C. In case of a difference in price, the Owner shall receive all benefit of the difference in cost involved in any substitution, and the contract altered by change order to credit Owner with any savings so obtained.

1.17 SERVICE AGENCIES

A. All mechanical equipment suppliers shall have an established authorized service agency located within a 50-mile radius of the project area. Within 15 days after award of the contract, submit to the A/E for review along with the list of material and equipment manufacturer’s names, a list of prospective service agencies to be used during the guarantee period. In the event any service agency in the list fails to comply with the specification requirements; such service agency will be rejected.

1.18 PERFORMANCE OF EQUIPMENT

A. All materials, equipment, and appurtenances of any kind, shown on the drawings, hereinafter specified or required for the completion of the work in accordance with the intent of these specifications, shall be completely satisfactory and acceptable in operation, performance and capacity. No approval either written or verbal of any drawings, descriptive data or samples of such material, equipment, and/or appurtenances shall relieve the Mechanical Contractor of his responsibility to turn over the same to the Owner in perfect working order at the completion of the work.

B. If the operation, capacity, or performance of any material, equipment, or appurtenance, does not comply with the drawings and/or specification requirements, or is damaged prior to acceptance by the Owner, respective item(s) will be considered defective. All defective items shall be removed and replaced with proper and acceptable materials, equipment, and/or appurtenances, or, put in proper and acceptable working order, satisfactory to the A/E, prior to final payment without additional cost to the Owner.

1.19 GUARANTY/WARRANTY

A. Materials, equipment, and systems furnished under these specifications shall be guaranteed against defects in material, design, and workmanship.

B. Contractor shall provide a list of equipment and the warranty periods as a submittal that will be reviewed by the Owner and the design team.

C. The guarantee period shall extend until the later of:

- A period of one (1) year from the date of final acceptance,
- Eighteen (18) months from the date of initial start-up.

D. The Contractor shall replace any material or equipment that comprises a part of any system that develops any defect during the guarantee period, at their expense.

E. All refrigeration equipment, air conditioners, etc. shall be provided with five (5) year extended compressor warranty covering both labor and materials.

F. Contractor shall turn over to the owner all warranties and guarantees upon completion and final acceptance of project.

1.20 OPERATING AND MAINTENANCE MANUALS

A. Contractor shall submit operating and maintenance instructions for all equipment furnished by them.

B. Maintenance and operating instructions shall be manuals prepared by the various manufacturers for the specific equipment furnished. Manuals shall cover such items as start-up procedures, trouble-shooting, periodic maintenance, etc. Advertising literature or catalogs will not be acceptable in this connection.

C. Three (3) sets of the above material shall be submitted to the A/E for review and approval.

D. Final job acceptance date shall be the date stamped on the operating and maintenance instructions and the guarantee period shall generally extend from that date.

1.21 CHARTS

A. Provide permanent type charts, framed under glass, mounted where directed as follows:

1. Valve charts giving valve use, system, and number on tag attached to valve.
2. Equipment and motor list giving system, equipment designation, and motor horsepower.
3. Automatic temperature control schematics and sequences of operation.
4. Lubrication instructions for all equipment giving type of lubricant and frequency.
5. Service organizations with normal and emergency telephone numbers.
6. Abbreviated operating instructions for all mechanical systems.

PART 2 - PRODUCTS

2.1 VIBRATION CONTROL

A. Vibration isolation devices shall be provided in accordance with Chapter 49, Table 42 ("Selection Guide for Vibration Isolation") of the American Society of Heating, Refrigerating, and Air-conditioning Engineers, Inc.'s (ASHRAE) 2019 Application Handbook.

2.2 ACCESSIBILITY

A. Locate all equipment that must be serviced, operated, or maintained, in fully accessible positions. Equipment shall include, but not be limited to, VAV terminal units, coils, valves, motors, controllers, dampers, drain points, traps, strainers, etc. The contractor shall rework, at their expense, any equipment that is deemed inaccessible to the satisfaction of the A/E.

B. Where required or directed by the A/E, provide access panels for access to all equipment where no other means of access is available. All access panels shall be of sufficient size to service and remove the equipment for which they are provided, and in no case, shall they have a clear opening less than 8" x 8". Access panels shall be set flush with finished surface and shall be held securely in place by means of integral anchoring lugs.

C. In finished walls they shall be smooth, polished nickel bronze access covers and full 8" x 8" openings.

D. Those in floors shall be square nickel bronze non-slip scoriated access covers.

E. Access panels in fire rated walls, floors, shafts, and partitions shall be labeled as such

and shall match the rating of the adjacent construction.

F. Access panels larger than 12" x 12" shall be of steel construction, having frames designed to suit the various locations and materials to which they are attached. The frames shall be rabbeted to receive cover and set flush with finished wall or ceiling surface. Covers shall be of rustproof furniture steel of not less than #14 gauge and shall be secured with suitable clips and locking cams or countersunk screws. Covers shall be flush with the frames and finished wall or ceiling surface.

G. Where accessible or removable ceilings are provided, ceiling panels or tiles may be removed to serve as access panels.

H. In general, access panels will <u>not</u> be indicated on the drawings. It shall be the Contractor's responsibility to anticipate these needs and to provide access panels as previously specified.

PART 3 - EXECUTION

3.1 EXAMINATION OF SITE

A. Each bidder shall be required to visit the site, examine the premises, and acquaint themselves with all existing and limiting conditions that may have bearing on the work before submitting proposals for the work. Due allowance shall be made in the bid for difficulties and contingencies that may be encountered.

B. Contractor will be allowed no extras arising out of their failure to make the above examination, or neglect to include all materials and labor required to complete the work.

C. Contractor shall familiarize themselves with all drawings and documents for the entire project.

D. By submitting a proposal, Contractor accepts the fact that tight conditions will likely occur at various locations. No extras will be approved for necessary variations and/or adjustments that may be required to resolve interferences.

E. Details of proposed changes found necessary by field conditions or other causes shall be submitted to the A/E for approval before proceeding with any such change.

F. No extra compensation will be allowed on account of a difference between actual dimensions and measurements at the site and those indicated on the drawings.

3.2 DIMENSIONS OF EXISTING STRUCTURES

A. Where the dimensions and locations of existing structures are of critical importance in the installation or connection of new work, verify such dimensions and locations in the field before the fabrication of any material or equipment that is dependent on the correctness of such information.

B. This stipulation applies specifically to existing sewer lines, manholes, etc. Establish exact invert of existing lines before beginning installation of any new work.

3.3 LINES, GRADES, AND MEASUREMENTS

A. Make all measurements and check all dimensions necessary for the proper construction of the work called for by the drawings and specifications. During the prosecution of the work, make all necessary measurements to prevent misfitting in said work, and for the accurate construction of the entire work.

3.4 COORDINATION

A. HVAC Contractor shall plan all phases of their portion of the project so that the work proceeds with a minimum of interference with other trades. They shall cooperate with all other Contractors in coordinating the locations of piping, ducts, etc., with lighting fixtures, structural members, sprinkler heads, etc.

B. HVAC Contractor shall check all project drawings prior to installing any equipment, pipes, ducts, etc. Any conflicts that become apparent because of cross checking drawings shall be resolved with the A/E prior to any work being done. Minor adjustments in location, size, and type of materials necessary to work out any interference shall be made at no extra cost. Being installed "first" in any situation will not be considered a factor in the proper resolution of a conflict.

3.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification; adequately packaged and protected to prevent damage during shipment, storage, and handing.

B. Store equipment and materials at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage.

C. If any materials or equipment are found to be damaged or in poor condition at the time installation, the A/E may, at their discretion, order the Contractor to furnish and install new materials or equipment at no additional expense to the owner.

3.6 PROTECTION

A. Protect all work, equipment, and materials at all times. All pipe openings shall be capped and plugged during installation.

B. All necessary precautions shall be taken to prevent damage to any work, materials, or equipment furnished by the Contractor. The Contractor shall be held responsible for all damage incurred to his work, materials, and equipment until his portion of the project is fully and finally accepted.

C. Drainage lines shall be kept free of dirt, concrete, or debris during construction. The contractor shall correct any blockages resulting from the above.

D. Protect make-up piping or accessories having polished, plated, or finished surfaces to avoid scarring. Protect fixtures or equipment having finished surfaces before, during, and after installation with special protective coatings for this purpose.

E. Do not install exposed polished metal fittings, parts, and devices, until adjoining tile or masonry has been finally acid cleaned.

F. All equipment, devices, controls, and motors shall be tightly covered and protected during construction up to the time of operation. Protection shall be arranged and of such design to prevent damage by infiltration of dust, dirt, debris, moisture, chemicals, or water. Minimum protection shall be by covering with transparent plastic sheeting to the satisfaction of the A/E.

G. The HVAC Contractor shall likewise protect from damage all materials, new and existing, turned over to them by others (including the Owner) for installation. The Contractor shall replace any material that becomes damaged at their expense.

3.7 CUTTING AND PATCHING

A. HVAC Contractor shall do all cutting necessary to properly install their materials, except as noted hereafter. This shall include cutting of existing concrete floors and walls. Cutting and patching of every nature required regarding this Contract shall be done with mechanics experienced in their respective lines of work. All patching shall match adjacent finishes.

B. All cutting in the building shall be done with great care so as not to leave an unsightly surface that may not be concealed by plates, escutcheons, or other normal concealing construction. If such unsightly conditions occur through fault of the Contractor, they shall be required to correct such deficiencies to the satisfaction of the Architect/Engineer.

C. All holes for piping shall be core drilled through existing concrete floors and walls.

D. No cutting of structural members shall be done until approval has been received from the A/E.

E. HVAC Contractor(s) shall do all patching required to restore the substrate to a condition that will readily receive new finishes. The General Contractor will provide all new finishes; tile, plaster, paint, etc.

F. HVAC Contractor shall provide the General Contractor or any other Contractors, which may be affected by his work, locations, and sizes of chases, sleeves, and openings required for installation of pipes, ducts, and other equipment. This information shall be presented to the General Contractor before pouring concrete or erecting walls to avoid unnecessary cutting and patching.

G. If openings are omitted or are incorrect through failure of the contractors to follow these instructions, the respective Contractors shall, at their own expense, engage the trade which originally installed the work, to cut and patch to the satisfaction of the A/E.

3.8 EQUIPMENT INSTALLATION AND CONNECTIONS

A. All equipment shall be installed and connected in accordance with the best engineering practice and in accordance with manufacturer's instructions and recommendations. Auxiliary piping, valves, and electric connections recommended by the manufacturer or required for proper operation shall be provided.

B. Any conflicts between the installation instructions indicated on the contract documents and the manufacturer's instructions and recommendations shall be brought to the attention of the A/E for resolution. The A/E's decision as to the final equipment installation and connections is final and any modifications necessary to obtain such an installation shall be made at no expense to the owner.

3.9 MOUNTING MECHANICAL DEVICES IN SUSPENDED CEILINGS

A. Support light troffers, air diffusers, grilles, etc. by supplementary hangers located within 6" of each corner. If the weight of the components causes the total dead load to exceed deflection capability of the main runners or cross runners, the components shall be supported independently of the suspension system by the installer of the components placed in ceiling.

B. Contractor shall carefully check existing suspension system for adequacy and completeness. He shall also test its supporting strength where additional weights are to be added due to changes of the existing HVAC or Electric systems.

END OF SECTION

SECTION 230500
COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Dielectric fittings.
3. Equipment installation requirements common to equipment sections.
4. Supports and anchorages.

1.2 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

C. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.

1.3 SUBMITTALS

A. Welding certificates.

1.4 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.6 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.

B. Coordinate requirements for access panels and doors for HVAC items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.2 JOINING MATERIALS

A. Refer to individual Division 23 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. Brazing Filler Metals: AWS A5.8, BCuP Series or BAg1, unless otherwise indicated.

F. Welding Filler Metals: Comply with AWS D10.12.

2.3 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

E. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

F. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors.

M. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.

N. Verify final equipment locations for roughing-in.

O. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

P. Provide drain pans under piping installed within electrical rooms or above electrical equipment.

3.2 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.3 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.

2. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.5 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.6 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor HVAC materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

END OF SECTION

SECTION 230513

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on alternating-current power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.2 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 NEMA MG 1 unless otherwise indicated.

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: Premium 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. Rotor: Random-wound, squirrel cage.

F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

G. Temperature Rise: Match insulation rating.

H. Insulation: Class F.

I. Code Letter Designation:

1. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.

J. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 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

SECTION 230529

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal-hanger shield inserts.
4. Fastener systems.
5. Equipment supports.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section 230548 "Vibration and Seismic Controls for HVAC" for vibration isolation devices.
3. Section 233113 "Metal Ducts" for duct hangers and supports.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.
2. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers 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. Detail fabrication and assembly of trapeze hangers.
2. Include design calculations for designing trapeze hangers.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.4 QUALITY ASSURANCE

A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design trapeze pipe hangers and equipment supports.

B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

2.2 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:
1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized, hot-dip galvanized, or electro-galvanized.
3. Nonmetallic Coatings: Plastic coated, or epoxy powder-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.

B. Copper Pipe and Tube Hangers:
1. Description: MSS SP-58, Types 1 through 58, copper-plated steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-plated steel.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.4 THERMAL-HANGER SHIELD INSERTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Buckaroos, Inc.
2. Carpenter & Paterson, Inc.
3. National Pipe Hanger Corporation.
4. Piping Technology & Products, Inc.
5. Value Engineered Products, Inc.

B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psi minimum compressive strength and vapor barrier.

C. Insulation-Insert Material for Hot Piping: Water-repellent-treated, ASTM C 533, Type I calcium silicate with 100-psi minimum compressive strength.

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.

2.5 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.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Hilti, Inc.
b. ITW Ramset/Red Head; Illinois Tool Works, Inc.

c. MKT Fastening, LLC.

d. Simpson Strong-Tie Co., Inc.

B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Hilti, Inc.

b. ITW Ramset/Red Head; Illinois Tool Works, Inc.

c. MKT Fastening, LLC.

2.6 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.7 MATERIALS

A. Aluminum: ASTM B 221.

B. Carbon Steel: ASTM A 1011/A 1011M.

C. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

D. Stainless Steel: ASTM A 240/A 240M.

E. Grout: ASTM C 1107/C 1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.

2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.

B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

3.2 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.

2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled strut systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. 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.

F. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.

2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 077200 "Roof Accessories" for curbs.

G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

I. 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.

J. Install lateral bracing with pipe hangers and supports to prevent swaying.

K. Install building attachments within concrete slabs or attach to structural steel. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

L. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

N. Insulated Piping:

1. Attach clamps and spacers to piping.

a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.

b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.

c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

a. Option: Thermal-hanger shield inserts may be used.

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.

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.

5. 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 bearing surface smooth.

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/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.5 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 1-1/2 inches.

3.6 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Touchup: Comply with requirements in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting" for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780/A 780M.

3.7 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports metal trapeze pipe hangers and metal framing systems and attachments for general service applications.

F. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.

G. Use padded hangers for piping that is subject to scratching.

H. Use thermal-hanger shield inserts for insulated piping and tubing.

I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. 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.
3. 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.
4. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
5. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
6. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
7. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
8. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.

J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
3. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.

L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
2. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
3. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
4. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
5. C-Clamps (MSS Type 23): For structural shapes.
6. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
7. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
8. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.

9. 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.
10. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
11. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
12. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

O. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

END OF SECTION

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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. Duct labels.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Brimar Industries, Inc.
   b. Carlton Industries, LP.
   c. Craftmark Pipe Markers.
   d. LEM Products Inc.
   e. Marking Services, Inc.
2. Material and Thickness: Brass, 0.032-inch stainless steel, 0.025-inch aluminum, 0.032-inch or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
3. Letter Color: Black.
4. Background Color: White.
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-quarters 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. Plastic Labels for Equipment:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Brady Corporation.
   b. Brimar Industries, Inc.
   c. Carlton Industries, LP.
   d. LEM Products Inc.
   e. Marking Services, Inc.

2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
3. Letter Color: Black.
4. Background Color: White.
5. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
6. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
7. 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-quarters the size of principal lettering.
8. Fasteners: Stainless-steel rivets or self-tapping screws.
9. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 PIPE LABELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Brady Corporation.
2. Brimar Industries, Inc.
3. Carlton Industries, LP.
4. LEM Products Inc.
5. Marking Sevices Inc.

B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction according to ASME A13.1.

C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.

D. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

E. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.
1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: Size letters according to ASME A13.1 for piping.

2.3 DUCT LABELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Brady Corporation.
2. Brimar Industries, Inc.
3. Carlton Industries, LP.

4. LEM Products Inc.
5. Marking Sevices Inc.

B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.

C. Letter Color: Black.

D. Background Color: White.

E. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

G. 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-quarters the size of principal lettering.

H. Fasteners: Stainless-steel rivets or self-tapping screws.

I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

J. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings; also include duct size and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions or as separate unit on each duct label to indicate flow direction.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces:

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 major equipment items and other points of origination and termination.
4. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
5. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

B. Pipe Label Color Schedule:

1. Refrigerant Piping: Black letters on a safety-orange background.

3.4 DUCT LABEL INSTALLATION

A. Install plastic-laminated self-adhesive duct labels with permanent adhesive on air ducts in the following color codes:

1. Blue: For cold-air supply ducts.
2. Yellow: For hot-air supply ducts.

3. Green: For exhaust-, outside-, relief-, return-, and mixed-air ducts.

B. Locate labels near points where ducts enter into and exit from concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

END OF SECTION

SECTION 230593

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Balancing Air Systems:

a. Constant-volume air systems.

b. Variable-air-volume systems.

1.2 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TAB: Testing, adjusting, and balancing.

D. TABB: Testing, Adjusting, and Balancing Bureau.

E. TAB Specialist: An independent entity meeting qualifications to perform TAB work.

F. TDH: Total dynamic head.

1.3 ACTION SUBMITTALS

A. TAB Report: Documentation indicating that Work complies with ASHRAE/IES 90.1, Section 6.7.2.3 - "System Balancing."

1.4 INFORMATIONAL SUBMITTALS

A. Strategies and Procedures Plan: Within 30 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

B. Certified TAB reports.

1.5 QUALITY ASSURANCE

A. TAB Specialists Qualifications: Certified by AABC.

1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC.

2. TAB Technician: Employee of the TAB specialist and certified by AABC as a TAB technician.

B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."

C. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.7.2.3 - "System Balancing."

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.

B. Examine installed systems for balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine equipment performance data including fan curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

F. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

G. Examine test reports specified in individual system and equipment Sections.

H. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.

I. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.

J. Examine operating safety interlocks and controls on HVAC equipment.

K. 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 for balancing the systems.

B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:

1. Airside:

a. Duct systems are complete with terminals installed.

b. Volume and fire dampers are open and functional.

c. Clean filters are installed.

d. Fans are operating, free of vibration, and rotating in correct direction.

e. Variable-frequency controllers' startup is complete and safeties are verified.

f. Automatic temperature-control systems are operational.

g. Ceilings are installed.

h. Windows and doors are installed.

i. Suitable access to balancing devices and equipment is provided.

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 Total System Balance" and in this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 233300 "Air Duct Accessories."

2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230713 "Duct Insulation."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling-unit components.

L. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

   a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.

   b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.

   c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.

   d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.

2. Measure fan static pressures as follows:

   a. Measure static pressure directly at the fan outlet or through the flexible connection.

   b. Measure static pressure directly at the fan inlet or through the flexible connection.

   c. Measure static pressure across each component that makes up the air-handling system.

   d. Report artificial loading of filters at the time static pressures are measured.

3. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.

4. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.

5. 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 occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.

1. Measure airflow of submain and branch ducts.
2. Adjust submain and branch duct volume dampers for specified airflow.
3. Re-measure each submain and branch duct after all have been adjusted.

C. Adjust air inlets and outlets for each space to indicated airflows.

1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
2. Measure inlets and outlets airflow.
3. Adjust each inlet and outlet for specified airflow.
4. Re-measure each inlet and outlet after they have been adjusted.

3.6 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

A. Adjust the variable-air-volume systems as follows:

1. Verify that the system static pressure sensor is located two-thirds of the distance down the duct from the fan discharge.
2. Verify that the system is under static pressure control.
3. Select the terminal unit that is most critical to the supply-fan airflow. Measure inlet static pressure, and adjust system static pressure control set point so the entering static pressure for the critical terminal unit is not less than the sum of the terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
4. Calibrate and balance each terminal unit for maximum and minimum design airflow as follows:
   a. Adjust controls so that terminal is calling for maximum airflow. Some controllers require starting with minimum airflow. Verify calibration procedure for specific project.
   b. Measure airflow and adjust calibration factor as required for design maximum airflow. Record calibration factor.
   c. When maximum airflow is correct, balance the air outlets downstream from terminal units.
   d. Adjust controls so that terminal is calling for minimum airflow.
   e. Measure airflow and adjust calibration factor as required for design minimum airflow. Record calibration factor. If no minimum calibration is available, note any deviation from design airflow.
   f. When in full cooling or full heating, ensure that there is no mixing of hot-deck and cold-deck airstreams unless so designed.
   g. On constant volume terminals, in critical areas where room pressure is to be maintained, verify that the airflow remains constant over the full range of full cooling to full heating. Note any deviation from design airflow or room pressure.
5. After terminals have been calibrated and balanced, test and adjust system for total airflow. Adjust fans to deliver total design airflows within the maximum allowable fan speed listed by fan manufacturer.
   a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.

b. Set terminals for maximum airflow. If system design includes diversity, adjust terminals for maximum and minimum airflow so that connected total matches fan selection and simulates actual load in the building.

c. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.

d. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.

e. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.

6. Measure fan static pressures as follows:

a. Measure static pressure directly at the fan outlet or through the flexible connection.

b. Measure static pressure directly at the fan inlet or through the flexible connection.

c. Measure static pressure across each component that makes up the air-handling system.

d. Report any artificial loading of filters at the time static pressures are measured.

7. Set final return and outside airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.

a. Balance the return-air ducts and inlets the same as described for constant-volume air systems.

b. Verify that terminal units are meeting design airflow under system maximum flow.

8. Re-measure the inlet static pressure at the most critical terminal unit and adjust the system static pressure set point to the most energy-efficient set point to maintain the optimum system static pressure. Record set point and give to controls contractor.

9. Verify final system conditions as follows:

a. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to match design if necessary.

b. Re-measure and confirm that total airflow is within design.

c. Re-measure final fan operating data, rpms, volts, amps, and static profile.

d. Mark final settings.

e. Test system in economizer mode. Verify proper operation and adjust if necessary. Measure and record all operating data.

f. Verify tracking between supply and return fans.

3.7 TOLERANCES

A. Set HVAC system's airflow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.

2. Air Outlets and Inlets: Plus or minus 10 percent.

B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.8 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.

2. Include a list of instruments used for procedures, along with proof of calibration.

3. Certify validity and accuracy of field data.

B. Final Report Contents: In addition to certified field-report data, include the following:
   1. Fan curves.
   2. Manufacturers' test data.
   3. Field test reports prepared by system and equipment installers.
   4. Other information relative to equipment performance; do not include Shop Drawings and Product Data.

C. General Report Data: In addition to form titles and entries, include the following data:
   1. Title page.
   2. Name and address of the TAB specialist.
   3. Project name.
   4. Project location.
   5. Architect's name and address.
   6. Engineer's name and address.
   7. Contractor's name and address.
   8. Report date.
   9. Signature of TAB supervisor who certifies the report.
   10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
   11. Summary of contents including the following:
      a. Indicated versus final performance.
      b. Notable characteristics of systems.
      c. Description of system operation sequence if it varies from the Contract Documents.
   12. Nomenclature sheets for each item of equipment.
   13. Data for terminal units, including manufacturer's name, type, size, and fittings.
   14. Notes to explain why certain final data in the body of reports vary from indicated values.
   15. Test conditions for fan performance forms including the following:
      a. Settings for outdoor-, return-, and exhaust-air dampers.
      b. Conditions of filters.
      c. Cooling coil, wet- and dry-bulb conditions.
      d. Face and bypass damper settings at coils.
      e. Fan drive settings including settings and percentage of maximum pitch diameter.
      f. Inlet vane settings for variable-air-volume systems.
      g. Settings for supply-air, static-pressure controller.
      h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air distribution systems. Present each system with single-line diagram and include the following:
   1. Quantities of outdoor, supply, return, and exhaust airflows.
   2. Duct, outlet, and inlet sizes.
   3. Terminal units.
   4. Balancing stations.
   5. Position of balancing devices.

E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:
   1. Unit Data:
      a. Unit identification.
      b. Location.
      c. Make and type.
      d. Model number and unit size.
      e. Manufacturer's serial number.
      f. Unit arrangement and class.
      g. Discharge arrangement.
      h. Sheave make, size in inches, and bore.
      i. Center-to-center dimensions of sheave and amount of adjustments in inches.
      j. Number, make, and size of belts.
      k. Number, type, and size of filters.
   2. Motor Data:
      a. Motor make, and frame type and size.
      b. Horsepower and rpm.
      c. Volts, phase, and hertz.
      d. Full-load amperage and service factor.
      e. Sheave make, size in inches, and bore.
      f. Center-to-center dimensions of sheave and amount of adjustments in inches.
   3. Test Data (Indicated and Actual Values):
      a. Total 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. Cooling-coil static-pressure differential in inches wg.
      g. Outdoor airflow in cfm.
      h. Return airflow in cfm.
      i. Outdoor-air damper position.
      j. Return-air damper position.
F. Apparatus-Coil Test Reports:
   1. Coil Data:
      a. System identification.
      b. Location.
      c. Coil type.
      d. Number of rows.
      e. Fin spacing in fins per inch o.c.
      f. Make and model number.
      g. Face area in sq. ft..
      h. Tube size in NPS.

i. Tube and fin materials.

j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm.

b. Average face velocity in fpm.

c. Air pressure drop in inches wg.

d. Outdoor-air, wet- and dry-bulb temperatures in deg F.

e. Return-air, wet- and dry-bulb temperatures in deg F.

f. Entering-air, wet- and dry-bulb temperatures in deg F.

g. Leaving-air, wet- and dry-bulb temperatures in deg F.

h. Refrigerant expansion valve and refrigerant types.

i. Refrigerant suction pressure in psig.

j. Refrigerant suction temperature in deg F.

G. Gas-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 Btu/h.

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. Center-to-center dimensions of sheave 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 Btu/h.

i. High-fire fuel input in Btu/h.

j. Manifold pressure in psig.

k. High-temperature-limit setting in deg F.

l. Operating set point in Btu/h.

m. Motor voltage at each connection.

n. Motor amperage for each phase.

o. Heating value of fuel in Btu/h.

H. 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 Btu/h.

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 Btu/h.

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.

I. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

a. System identification.

b. Location.

c. Make and type.

d. Model number and size.

e. Manufacturer's serial number.

f. Arrangement and class.

g. Sheave make, size in inches, and bore.

h. Center-to-center dimensions of sheave and amount of adjustments in inches.

2. Motor Data:

a. Motor make, and frame type and size.

b. Horsepower and rpm.

c. Volts, phase, and hertz.

d. Full-load amperage and service factor.

e. Sheave make, size in inches, and bore.

f. Center-to-center dimensions of sheave, and amount of adjustments in inches.

g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.

b. Total system static pressure in inches wg.

c. Fan rpm.

d. Discharge static pressure in inches wg.

e. Suction static pressure in inches wg.

J. Round 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.

K. Air-Terminal-Device Reports:

1. Unit Data:

a. System and air-handling unit identification.

b. Location and zone.

c. Apparatus used for test.

d. Area served.

e. Make.

f. Number from system diagram.

g. Type and model number.

h. Size.

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.

L. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.

b. Serial number.

c. Application.

d. Dates of use.

e. Dates of calibration.

3.9 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION

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SECTION 230713
DUCT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following duct services:

1. Indoor, concealed supply and outdoor air.
2. Indoor, concealed return located in unconditioned space.
3. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
4. Exposed, Outdoor-Air Duct and Plenum Insulation.

B. Related Sections:

1. Section 230719 "HVAC Piping Insulation."
2. Section 233113 "Metal Ducts" for duct liners.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
3. Detail application of field-applied jackets.
4. Detail application at linkages of control devices.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Rigid fiberglass Insulation System: Insulation shall be rigid fiberglass insulation system for hot and cold temperature service consisting of a rigid board of glass fibers with a non-combustible vapor barrier facing. Board shall be UL labeled, "K" of 0.25 at 75°F mean temperature, 3 lb. density. Facing shall be type FRK consisting of a foil reinforced Kraft vapor barrier laminate.

G. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. CertainTeed Corporation.

b. Johns Manville; a Berkshire Hathaway company.

c. Knauf Insulation.

d. Manson Insulation Inc.

e. Owens Corning.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Childers Brand; H. B. Fuller Construction Products.

b. Eagle Bridges - Marathon Industries.

c. Foster Brand; H. B. Fuller Construction Products.

d. Mon-Eco Industries, Inc.

C. FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Childers Brand; H. B. Fuller Construction Products.

b. Eagle Bridges - Marathon Industries.

c. Foster Brand; H. B. Fuller Construction Products.

d. Mon-Eco Industries, Inc.

2.3 MASTICS

A. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Childers Brand; H. B. Fuller Construction Products.

b. Foster Brand; H. B. Fuller Construction Products.

c. Knauf Insulation.

d. Vimasco Corporation.

2. Water-Vapor Permeance: ASTM E 96/E 96M, 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, 58 percent by volume and 70 percent by weight.

5. Color: White.

B. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Childers Brand; H. B. Fuller Construction Products.

b. Foster Brand; H. B. Fuller Construction Products.

c. Knauf Insulation.

d. Vimasco Corporation.

2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.

3. Service Temperature Range: Minus 20 to plus 180 deg F.

4. Solids Content: 60 percent by volume and 66 percent by weight.

5. Color: White.

2.4 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Childers Brand; H. B. Fuller Construction Products.

b. Eagle Bridges - Marathon Industries.

c. Foster Brand; H. B. Fuller Construction Products.

d. Mon-Eco Industries, Inc.

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.

2.5 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.6 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

2.7 TAPES

A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Avery Dennison Corporation, Specialty Tapes Division.

b. Ideal Tape Co., Inc., an American Biltrite Company.

c. Knauf Insulation.

d. Venture Tape.

2. Width: 3 inches.

3. Thickness: 6.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

2.8 SECUREMENTS

A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. ITW Insulation Systems; Illinois Tool Works, Inc.
      b. RPR Products, Inc.

B. Insulation Pins and Hangers:
   1. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
      a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         1) AGM Industries, Inc.
         2) Gemco.
         3) Hardcast, Inc.
         4) Midwest Fasteners, Inc.
         5) Nelson Stud Welding.
      b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
      c. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
      d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.

D. Wire: 0.062-inch soft-annealed, stainless steel.
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. C & F Wire.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

   1. Install insulation continuously through hangers and around anchor attachments.

   2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.

   3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:

   1. Draw jacket tight and smooth.

   2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.

   3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

      a. For below ambient services, apply vapor-barrier mastic over staples.

   4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.

   5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.3 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 Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

3.4 INSTALLATION OF MINERAL-FIBER INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts (except for top surface of horizontal rectangular ducts) and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
   a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
   b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
   c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
   d. Do not overcompress insulation during installation.
   e. Impale insulation over pins and attach speed washers.
   f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
   a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
   b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.

6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.5 FIELD-APPLIED JACKET INSTALLATION

A. Where FSK jackets are indicated, install as follows:
1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:
1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.7 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:
1. Indoor, concealed supply and outdoor air.
2. Indoor, concealed return located in unconditioned space.
3. Indoor, concealed exhaust between isolation damper and penetration of building exterior.

B. Items Not Insulated:
1. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
2. Factory-insulated flexible ducts.
3. Factory-insulated plenums and casings.
4. Flexible connectors.
5. Vibration-control devices.
6. Factory-insulated access panels and doors.

3.8 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, Supply-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches thick (R-5) and 0.75-lb/cu. ft. nominal density.

B. Concealed, Return-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches thick (R-5) and 0.75-lb/cu. ft. nominal density.

C. Concealed, Exhaust-Air Duct and Plenum Insulation: Mineral-fiber blanket, 2 inches thick (R-5) and 0.75-lb/cu. ft. nominal density.

D. Exposed, Duct and Plenum Insulation (ductwork in Process Areas to be considered Exposed): Rigid fiberglass insulation system, 2 inches (R-5) and 0.75-lb/cu. ft. nominal density.

END OF SECTION

SECTION 230923
DIRECT DIGITAL (DDC) CONTROL SYSTEM FOR HVAC

PART 1 – GENERAL

1.1 GENERAL

A. Scope of Work

B. Approved Control System Contractors/Manufacturers

C. Quality Assurances

D. Submittals

E. Warranty

F. System Maintenance

1.2 SCOPE OF WORK

A. The control system shall be as described in the specifications, and shall consist of a peer-to-peer network of digital building control panels and an operator workstation. The user interface shall also be through any personal computer available on the network. The PC shall provide users an interface with the system through dynamic color graphics of building areas and systems.

B. Direct Digital Control (DDC) technology shall be used to provide the functions necessary for control of systems defined for control on this project.

C. The control system shall accommodate simultaneous multiple user operation. Access to the control system data should be limited by operator ID and password. An operator shall be able to log onto any PC on the designated network and have access to all designated data.

D. The control system shall be designed such that each mechanical system will operate under stand-alone control. As such, in the event of a network communication failure, or the loss of other controllers, the control system shall continue to independently operate the unaffected equipment.

E. Communication between the control panels and all workstations shall be over a high-speed network. All nodes on this network shall be peers. Internet connectivity shall be provided for remote access to the system.

1.3 APPROVED CONTROL SYSTEM CONTRACTORS AND MANUFACTURERS

A. Trane Tracer, SC or approved equivalent by:

B. Johnson Controls, Metasys

C. NRG Controls, Schneider Electric

1.4 QUALITY ASSURANCES

A. System Installer Qualifications

1. The installer shall have an established working relationship with the control system manufacturer of not less than three years.
2. The installer shall have successfully completed control system manufacturer's classes on the control system. The installer shall present for review the certification of completed training, including the hours of instruction and course outlines upon request.
3. The installer shall have an office within 50 miles of the project site and provide 24-hour response in the event of a customer call.

1.5 SUBMITTALS

A. Contractor shall provide shop drawings and manufacturers' standard specification data sheets on all hardware and software to be provided. No work may begin on any segment of this project until the Engineer and Owner have reviewed submittals for conformity with the plan and specifications. Six (6) copies are required unless specifically noted that electronic copies are acceptable. All shop drawings shall be provided to the Owner electronically as .dwg or .dxf file formats.

1. Quantities of items submitted shall be reviewed by the Engineer and Owner. Such review shall not relieve the contractor from furnishing quantities required for completion.
2. Provide the Engineer and Owner, any additional information or data which is deemed necessary to determine compliance with these specifications or which is deemed valuable in documenting the system to be installed.
3. Submit the following within 30 days of contract award:
   a. A complete bill of materials of equipment to be used indicating quantity, manufacturer and model number.
   b. A schedule of all control dampers. This shall include the damper size, pressure drop, manufacturer and model number.
   c. Provide manufacturers cut sheets for major system components. When manufacturer's cut sheets apply to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted or clearly indicated by other means. Each submitted piece of literature and drawings shall clearly reference the specification and/or drawing that the submittal is being submitted to cover. Include:
      1) Building Controllers
      2) Custom Application Controllers
      3) Application Specific Controllers
      4) Operator Interface Computer
      5) Auxiliary Control Devices
      6) Proposed control system riser diagram showing system configuration, device locations, addresses, and cabling.
      7) Detailed termination drawings showing all required field and factory terminations. Terminal numbers shall be clearly labeled.
      8) Points list showing all system objects, and the proposed English language object names.
      9) Sequence of operations for each system under control. This sequence shall be specific for the use of the control system being provided for this project.
      10) Provide a BACnet Product Implementation Conformance Statement (PICS) for each BACnet device type in the submittal.
      11) Color prints of proposed graphics with a list of points for display.

B. Project Record Documents. Upon completion of installation submit three (3) copies of record (as-built) documents. The documents shall be submitted for approval prior to final completion and include:

1. Project Record Drawings. These shall be as-built versions of the submittal shop drawings. One set of electronic media including CAD .DWG or .DXF drawing files shall also be provided.
2. Testing and Commissioning Reports and Checklists.

3. Operating and Maintenance (O & M) Manual. These shall be as-built versions of the submittal product data. In addition to that required for the submittals, the O & M manual shall include:
    a. Names, address and 24-hour telephone numbers of Contractors installing equipment, and the control systems and service representative of each.
    b. Operators Manual with procedures of operating the control systems including logging on/off, alarm handling, producing point reports, trending data, overriding computer control, and changing set points and other variables.
    c. Programming Manual with a description of the programming language including syntax, statement descriptions including algorithms and calculations used, point database creation and modification, program creation and modification, and use of the editor.
    d. Engineering, Installation and Maintenance Manual(s) that explains how to design and install new points, panels, and other hardware; preventative maintenance and calibration procedures; how to debug hardware problems; and how to repair or replace hardware. A listing and documentation of all custom software created using the programming language including the point database. One set of magnetic media containing files of the software and database shall also be provided.
    e. One set of electronic media containing files of all color-graphic screens created for the project.
    f. Complete original issue documentation, installation, and maintenance information for all third-party hardware provided including computer equipment and sensors.
    g. Complete original issue media for all software provided including operating systems, programming language, operator workstation software, and graphics software.
    h. Licenses and warranty documents for all equipment and systems.
    i. Recommended preventive maintenance procedures for all system components including a schedule of tasks, time between tasks, and task descriptions.

C. Training Materials: The Contractor shall provide a course outline and training material for all training classes at least six weeks prior to the first class. The Owner reserves the right to modify any or all of the training course outline and training materials. Review and approval by Owner and Engineer shall be completed at least 3 weeks prior to first class.

1.6 WARRANTY

A. Warrant all work as follows:
    1. Labor and materials for control system specified shall be warranted free from defects for a period of twelve (12) months after final completion acceptance by the Owner. Control System failures during the warranty period shall be adjusted, repaired, or replaced at no charge or reduction in service to the Owner. The Contractor shall respond to the Owner's request for warranty service within 24 hours during customary business hours.
    2. At the end of the final start-up/testing, if equipment and systems are operating satisfactorily to the Owner and Engineer, the Owner shall sign certificates certifying that the control system's operation has been tested and accepted in accordance with the terms of this specification. The date of Owner's acceptance shall be the start of warranty.
    3. Operator workstation software, project specific software, graphics, database, and firmware updates shall be provided to the Owner at no charge during the warranty period. Written authorization by Owner must, however, be granted prior to the installation of such changes.
    4. The system provider shall provide a web-accessible system and support on-line resource that provides the Owner access to a question/answer forum, graphics library, user tips, upgrades, and manufacturer training schedules.

1.7 SYSTEM MAINTENANCE

A. Perform Building Automation System preventative maintenance and support for a period of one year (beginning the date of substantial completion).

1. Make a minimum of 2 complete Building Automation System inspections (onsite or remote), in addition to normal warranty requirements. Inspections to include.

   a. System Review – Review the BAS to correct, failed points, points in alarm, and points that have been overridden manually.

   b. Seasonal Control Loop Tuning – Control loops are reviewed to reflect changing seasonal conditions and / or facility heating and cooling loads

   c. Sequence of operation verification – Systems all verified to be operating as designed and in automatic operation. Scheduling and setpoints are reviewed and modified.

   d. Setback adjustment tuning

   e. Database back-up

   f. Operator coaching

   g. Technician shall review critical alarm log and advise owner of additional services that may be required.

2. Provide local remote monitoring services within 50 miles of the project site to access and diagnose system capabilities and troubleshooting of the Building Automation System to assist with inspections and any service calls needed. Owner to provide VPN access to building network if firewall exists.

PART 2 - PRODUCTS

2.1 PART INCLUDES

A. General Description

B. Architecture/Communication

C. Operator Interface

D. Application and Control Software

E. System Controllers

F. Input/Output Modules

G. Unit Level Controllers

H. Auxiliary Control Devices

I. Local Control Panels.

2.2 GENERAL DESCRIPTION

A. The Trane Tracer SC system is an open protocol web-based building automation system (BAS) which utilizes a tier network of system level and unit level direct digital controllers to control and manage the building HVAC. The use of wired and secure wireless communication protocols adds to the flexibility of the system. The BAS system has the ability to integrate multiple other building systems through the open communication BACnet/IP to provide a single multiple user access point to the facilities automated systems, all through a common internet browser.

2.3 ARCHITECTURE/COMMUNICATION

A. This project shall be comprised of a high-speed Ethernet network utilizing BACnet/IP communications between System Controllers and Workstations. Communications between System Controllers and sub-networks of Custom Application Controllers and/or Application Specific Controllers shall utilize BACnet MSTP (RS485) communications.

1. Each System Controller shall perform communications to a network of Custom Application and Application Specific Controllers using BACnet/MSTP (RS485) as defined by the BACnet standard.

   a. Each System Controller shall function as a BACnet Router to each unit controller providing a unique BACnet Device ID for all BACnet/MSTP controllers within the system.

2. The Owner will provide all communication media, connectors, repeaters, network switches, and routers necessary for the high-speed Ethernet network. An active Ethernet port will be provided adjacent to each System Controller and operator interface (PC) for connection to this high-speed Ethernet network.

3. All values within the system (i.e. schedules, data logs, points, software variables, custom program variables) shall be readable and controllable (where appropriate) by any System Controller or BACnet Workstation on the communications network via BACnet.

B. Wireless equipment controllers and auxiliary control devices shall conform to:

1. IEEE 802.15.4 radios to minimize risk of interference and maximize battery life, reliability, and range.

2. Operating range shall be a minimum of 200 feet; open range shall be 2,500 ft. (762 m) with less than 2% packet error rate.

3. To check for proper operation, wireless zone temperature sensors shall include a signal strength and battery condition indicators on the zone sensor display or using LED's on non-display models.

4. To maintain robust communication, two-way communications shall be used between the wireless zone sensor and receiver to allow channel switching based on varying channel traffic and signal strength.

5. The wireless zone sensor and receiver addresses shall be held in non-volatile memory to ensure operation through system voltage disturbances and to minimize the risk of incorrect association.

6. The wireless zone sensor and receiver shall be addressed using rotary switches with numerical indication to simplify and reduce installation time and minimize risk of incorrect addressing. Two position DIP switches are not acceptable.

7. Installation and replacement of failed sensors shall be accomplished automatically after power up.

8. To allow local troubleshooting without specialized tools, error codes shall be displayed on the digital display through a blinking pattern on the non-display models. Error codes shall include: not associated, address to 000, improper software configuration, input voltage too high, or general sensor failure. Codes shall be indicated on inside of sensor back cover.

9. Certifications shall include FCC CFR47 - RADIO FREQUENCY DEVICES - Section 15.247 & Subpart E.

2.4 OPERATOR INTERFACE

A. The building owner shall furnish all PC based operator interfaces as shown on the system drawings. Each operator interface shall be able to access all information in the system. The operator interface shall reside on the Enterprise-wide network, which is same high-speed communications network as the System Controllers. The Enterprise-wide network will be provided by the owner and supports the Internet Protocol (IP).

1. Each PC based operator interface shall include the following:
   a. Hardware type
   b. PC
2. Operating Systems
   a. Windows XP
   b. Windows 7
3. Minimum Hardware
   a. Pentium Core 2 DUO or better
   b. 4 GB RAM
   c. 100 GB hard drive space
   d. Internet Browser compatible with operator interface requirements outlined in the operator interface section.
   e. Java Runtime Environment (JRE) V6.0 or higher
4. Operator Interface
   a. The operator interface shall be accessible via a web browser.
   b. The operator interface shall support the following Internet web browsers:
      1) Internet Explorer 8.0+
      2) Firefox 4.0+
      3) Chrome 10.0+
   c. The operator interface shall support the following mobile web browsers:
      1) iOS (iPad/iPhone) V4.0+
      2) Android (Tablet) V4.0+
      3) Android (Phone) V2.3+
   d. System Security
      1) Each operator shall be required to login to the system with a user name and password in order to view, edit, add, or delete data.
      2) User Profiles shall restrict the user to only the objects, applications, and system functions as assigned by the system administrator.
      3) Each operator shall be allowed to change their user password
      4) The System Administrator shall be able to manage the security for all other users
      5) The system shall include pre-defined “roles” that allow a system administrator to quickly assign permissions to a user.
      6) User logon/logoff attempts shall be recorded.
      7) The system shall protect itself from unauthorized use by automatically logging off following the last keystroke. The delay time shall be user definable.
      8) All system security data shall be stored in an encrypted format.

e. Database

1) Save. A system operator with the proper password clearance shall be able to archive the Database data-base on the designated operator interface PC.

2) Database Restore. The system operator shall also be able to clear a panel database and manually initiate a download of a specified database to any panel in the system.

f. On-Line Help and Training

1) Provide a context sensitive, on line help system to assist the operator in operation and configuration of the system.

2) On-line help shall be available for all system functions and shall provide the relevant data for each screen.

g. System Diagnostics

1) The system shall automatically monitor the operation of all network connections, building management panels, and controllers.

2) The failure of any device shall be annunciated to the operator.

h. Equipment & Application Pages

1) The operator interface shall include standard pages for all equipment and applications. These pages shall allow an operator to obtain information relevant to the operation of the equipment and/or application, including:

a) Animated Equipment Graphics for each major piece of equipment and floor plan in the System. This includes:

- Each Rooftop Unit, Rooftop Unit, Variable Air Volume Box, Exhaust Fan, etc. These graphics shall show all points dynamically as specified in the points list.
- Animation capabilities shall include the ability to show a sequence of images reflecting the position of analog outputs, such as damper positions. Graphics shall be capable of launching other web pages.

2) Alarms relevant to the equipment or application without requiring a user to navigate to an alarm page and perform a filter.

3) Historical Data (As defined in Automatic Trend Log section below) for the equipment or application without requiring a user to navigate to a data log page and perform a filter.

i. System Graphics

1) Operator interface shall be graphically based and shall include at least one graphic per piece of equipment or occupied zone and graphics that summarize conditions on each floor of each building included in this contract. Indicate thermal comfort on floor plan summary graphics using colors to represent zone temperature relative to zone set point.

2) Functionality. Graphics shall allow operator to monitor system status, to view a summary of the most important data for each controlled zone or piece of equipment, to use point and-click navigation between zones or equipment, and to edit set points and other specified parameters.

3) Graphic imagery. Graphics shall use 3D images for all standard and custom graphics. The only allowable exceptions will be photo images, maps, schematic drawings, and selected floor plans.

4) Animation. Graphics shall be able to animate by displaying different Image lies for changed object status.

5) Alarm Indication. Indicate areas or equipment in an alarm condition using color or other visual indicator.

6) Format. Graphics shall be saved in an industry-standard format such as BMP, JPEG, PNG, or GIF. Web-based system graphics shall be viewable on browsers compatible with World Wide Web Consortium browser standards. Web graphic format shall require no plug-in (such as HTML and JavaScript) or shall only require widely available no-cost plug-ins (such as Active-X and Macromedia Flash).

j. Custom Graphics

1) The operator interface shall be capable of displaying custom graphics in order to convey the status of the facility to its operator.

2) Graphical Navigation. The operator interface shall provide dynamic color graphics of building areas, systems and equipment.

3) Graphical Data Visualization. The operator interface shall support dynamic points including analog and binary values, dynamic text, static text, and animation files.

4) Custom background images. Custom background images shall be created with the use of commonly available graphics packages such as Adobe Photoshop. The graphics generation package shall create and modify graphics that are saved in industry standard formats such as GIF and JPEG.

k. Graphics Library

1) Furnish a library of standard HVAC equipment such as chillers, air handlers, terminals, fan coils, unit ventilators, rooftop units, and VAV boxes, in 3-dimensional graphic depictions. The library shall be furnished in a file format compatible with the graphics generation package program.

l. Manual Control and Override

1) Point Control. Provide a method for a user to view, override, and edit if applicable, the status of any object and property in the system. The point status shall be available by menu, on graphics or through custom programs.

2) Temporary Overrides. The user shall be able to perform a temporary override wherever an override is allowed, automatically removing the override after a specified period of time.

3) Override Owners. The system shall convey to the user the owner of each override for all priorities that an override exists.

4) Provide a specific icon to show timed override or operator override, when a point, unit controller or application has been overridden manually.

m. Engineering Units

1) Allow for selection of the desired engineering units (i.e. Inch pound or SI) in the system.

2) Unit selection shall be able to be customized by locality to select the desired units for each measurement.

3) Engineering units on this project shall be IP.

B. Scheduling. A user shall be able to perform the following tasks utilizing the operator interface:

1. Create a new schedule, defining the default values, events and membership.
2. Create exceptions to a schedule for any given day.
3. Apply an exception that spans a single day or multiple days.
4. View a schedule by day, week and month.
5. Exception schedules and holidays shall be shown clearly on the calendar.

6. Modify the schedule events, members and exceptions.

C. Trend Logs

1. Trend Logs Definition

   a. The operator interface shall allow a user with the appropriate security permissions to define a trend log for any data in the system.

   b. The operator interface shall allow a user to define any trend log options as described in the Application and Control Software section.

2. Trend Log Viewer

   a. The operator interface shall allow Trend Log data to be viewed and printed.

   b. The operator interface shall allow a user to view trend log data in text-based (time – stamp/value).

   c. The operator shall be able to view the data collected by a trend log in a graphical chart in the operator interface.

   d. Trend log viewing capabilities shall include the ability to show a minimum of 5 points on a chart.

   e. Each data point trend line shall be displayed as a unique color.

   f. The operator shall be able to specify the duration of historical data to view by scrolling and zooming.

   g. The system shall provide a graphical trace display of the associated time stamp and value for any selected point along the x-axis.

3. Export Trend Logs

   a. The operator interface shall allow a user to export trend log data in CSV or PDF format for use by other industry standard word processing and spreadsheet packages.

4. Alarm/Event Notification

   a. An operator shall be notified of new alarms/events as they occur while navigating through any part of the system via an alarm icon.

   b. Alarm/Event Log. The operator shall be able to view all logged system alarms/events from any operator interface.

      1) The operator shall be able to sort and filter alarms from events. Alarms shall be sorted in a minimum of 4 categories based on severity.

      2) Alarm/event messages shall use full language, easily recognized descriptors.

      3) An operator with the proper security level may acknowledge and clear alarms/events.

      4) All alarms/events that have not been cleared by the operator shall be stored by the building controller.

      5) The alarm/event log shall include a comment field for each alarm/event that allows a user to add specific comments associated with any alarm.

   c. Alarm Processing

      1) The operator shall be able to configure any object in the system to generate an alarm when transitioning in and out of a normal state.

      2) The operator shall be able to configure the alarm limits, warning limits, states, and reactions for each object in the system.

5. Reports and Logs

   a. The operator interface shall provide a reporting package that allows the operator to select reports.

b. The operator interface shall provide the ability to schedule reports to run at specified intervals of time.

c. The operator interface shall allow a user to export reports and logs from the building controller in a format that is readily accessible by other standard software applications including spreadsheets and word processing. Acceptable formats include:

1) CSV, HTML, XML, PDF

d. Reports and logs shall be readily printed to the system printer.

e. Provide a means to list and access the last 10 reports viewed by the user.

f. The following standard reports shall be available without requiring a user to manually configure the report:

1) All Points in Alarm Report: Provide an on-demand report showing all current alarms.

2) All Points in Override Report: Provide an on-demand report showing all overrides in effect.

3) Commissioning Report: Provide a one-time report that lists all equipment with the unit configuration and present operation.

4) Points report: Provide a report that lists the current value of all points.

6. Custom Application Programming. Provide the tools to create, modify, and debug custom application programming. The operator shall be able to create, edit, and download custom programs while all other system applications are operating. The system shall be fully operable while custom routines are edited, compiled, and downloaded.

7. Custom Graphic Editor. Provide the tools to create, modify, and debug custom graphics. The operator shall be able to create, edit, and download custom graphics at the same time that all other system applications are operating. The system shall be fully operable while custom graphics are edited, compiled, and downloaded.

2.5 APPLICATION AND CONTROL SOFTWARE

A. Furnish the following applications software for building and energy management. All software applications shall reside and run in the system controllers. Editing of applications shall occur at the operator interface.

1. Scheduling. Provide the capability to schedule each object or group of objects in the system. Each of these schedules shall include the capability for start, stop, optimal start, optimal stop, and night economizer actions. Each schedule may consist of up to [10] events. When a group of objects are scheduled together, provide the capability to define advances and delays for each member. Each schedule shall consist of the following:

a. Weekly Schedule. Provide separate schedules for each day of the week.

b. Exception Schedules. Provide the ability for the operator to designate any day of the year as an exception schedule. This exception schedule shall override the standard schedule for that day. Exception schedules may be defined up to a year in advance. Once an exception schedule is executed it will be discarded and replaced by the standard schedule for that day of the week.

c. Holiday Schedules. Provide the capability for the operator to define up to 99 special or holiday schedules. These schedules may be placed on the scheduling calendar and will be repeated each year. The operator shall be able to define the length of each holiday period.

d. Optimal Start. The scheduling application outlined above shall support an optimal start algorithm. This shall calculate the thermal characteristics of a zone and start the equipment prior to occupancy to achieve the desired space temperature at the specified occupancy time. The algorithm shall calculate separate sets of heating and cooling rates for zones that have been unoccupied for less then and greater than 24 hours. Provide the ability to modify the start algorithm based on outdoor air temperature. Provide an early start limit in minutes to prevent the system from starting before an operator determined time limit.

2. Trend Log Application

a. Trend log data shall be sampled and stored on the System Controller panel and shall capable of being archived to a BACnet Workstation for longer term storage.

1) Trend logs shall include interval, start-time, and stop-time.

2) Trend log intervals shall be configurable as frequently as 1 minute and as infrequently as 1 year.

b. Automated Trend Logs

1) The system controller shall automatically create trend logs for defined key measurements for each controlled HVAC device and HVAC application.

2) The automatic trend logs shall monitor these parameters for a minimum of 7 days at 15-minute intervals. The automatic trend logs shall be user adjustable.

c. Alarm/Event Log

1) Any object in the system shall be configurable to generate an alarm when transitioning in and out of a normal or fault state.

2) Any object in the system shall allow the alarm limits, warning limits, states, and reactions to be configured for each object in the system.

3) An alarm/event shall be capable of triggering any of the following actions:

a) Route the alarm/event to one or more alarm log

4) The alarm message shall include the name of the alarm location, the device that generated the alarm, and the alarm message itself.

a) Route an e-mail message to an operator(s)

b) Log a data point(s) for a period of time

c) Run a custom control program

3. Point Control. User shall have the option to set the update interval, minimum on/off time, event notification, custom programming on change of events.

4. Timed Override. A standard application shall be utilized to enable/disable temperature control when a user selects on/cancel at the zone sensor, operator interface, or the local operator display. The amount of time that the override takes precedence will be selectable from the operator interface.

5. Anti-Short Cycling. All binary output points shall be protected from short cycling

2.6 SYSTEM CONTROLLERS

A. There shall be one or more independent, standalone microprocessor-based system controllers to manage the global strategies described in application and control software section.

1. The System Controller shall have sufficient memory to support its operating system, database, and programming requirements.

2. The controller shall provide a USB communications port for connection to a PC

3. The operating system of the Controller shall manage the input and output communications signals to allow distributed controllers to share real and virtual point information and allow central monitoring and alarms.

4. All System Controllers shall have a real-time clock.
5. Data shall be shared between networked System Controllers.
6. The System Controller shall continually check the status of its processor and memory circuits. If an abnormal operation is detected, the controller shall:
   a. Assume a predetermined failure mode.
   b. Generate an alarm notification.
   c. Create a retrievable file of the state of all applicable memory locations at the time of the failure.
   d. Automatically reset the System Controller to return to a normal operating mode.
7. Environment. Controller hardware shall be suitable for the anticipated ambient conditions. Controller used in conditioned ambient shall be mounted in an enclosure, and shall be rated for operation at -40 F to 122 F.
8. Clock Synchronization
   a. All System Controllers shall be able to synchronize with a NTP server for automatic time synchronization.
   b. All System Controllers shall be able to accept a BACnet time synchronization command for automatic time synchronization.
   c. All System Controllers shall automatically adjust for daylight savings time if applicable.
9. Serviceability
   a. Provide diagnostic LEDs for power, communications, and processor.
   b. The System Controller shall have a display on the main board that indicates the current operating mode of the controller.
   c. All wiring connections shall be made to field removable, modular terminal connectors.
   d. The System controller shall utilize standard DIN mounting methods for installation and replacement.
10. Memory. The System Controller shall maintain all BIOS and programming information indefinitely without power to the System controller.
11. Immunity to power and noise. Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shut-down below 80% nominal voltage
12. BACnet Test Labs (BTL) Listing. Each System Controller shall be listed as a Building Controller (B-BC) by the BACnet Test Labs

2.7 INPUT/OUTPUT INTERFACE

A. Hard-wired inputs and outputs may tie into the system through Custom, or Application Specific Controllers.

B. All input points and output points shall be protected such that shorting of the point to itself, another point, or ground will cause no damage to the controller. All input and output points shall be protected from voltage up to 24V of any duration, such that contact with this voltage will cause no damage to the controller.

C. Binary inputs shall allow the monitoring of on/off signals from remote devices. The binary inputs shall provide a wetting current of at least 12 mA to be compatible with commonly available control devices.

D. Pulse accumulation input points. This type of point shall conform to all the requirements of Binary Input points, and accept up to 3 pulses per second for pulse accumulation, and shall be protected against effects of contact bounce and noise.

E. Analog inputs shall allow the monitoring of low voltage (0-10 Vdc), current (4-20 ma), or resistance signals (thermistor, RTD). Analog inputs shall be compatible with, and field configurable to commonly available sensing devices.

F. Binary outputs shall provide for on/off operation. Terminal unit and zone control applications may use 2 outputs for drive-open, drive-close (tri-state) modulating control.

G. Analog outputs shall provide a modulating signal for the control of end devices. Outputs shall provide either a 0-10 Vdc or a 4-20 ma signal as required to provide proper control of the output device.

2.8 UNIT LEVEL CONTROLLERS

A. Programmable Controllers

1. Environment. Controller hardware shall be suitable for the anticipated ambient conditions.

   a. Controller used in conditioned ambient shall be mounted in NEMA 1 type enclosures, and shall be rated for operation at 0 C to 50 C [32 F to 120 F].

   b. Controllers used outdoors and/or in wet ambient shall be mounted within NEMA 4 type waterproof enclosures, and shall be rated for operation at -40 F to 158 F.

2. Serviceability. Custom Application Controller shall possess diagnostic LED's indicating power, communications, and processor functions. All wiring connections shall be terminated at field removable, modular terminal strips, or at communication board.

3. Memory. The Controller shall maintain all BIOS and programming information in the event of a power loss for minimum of (72) continuous hours.

B. Immunity to power and noise. Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage.

C. Application Specific Controllers (ASC) shall be microprocessor-based DDC controllers which through hardware or firmware design control specified equipment. They are not user programmable, but are customized for operation within the confines of the equipment they are designed to serve.

1. Application Specific Controller are only allowed when both the following:

   a. The equipment is compressor based or boiler based and

   b. The controller is provided by the equipment manufacturer and warrantied as part of the equipment.

D. Zone Controllers are controllers that operate equipment that control the space temperature of single zone. Examples are controllers for VAV, Fan coil, Blower Coils, Unit Ventilators, Heat Pumps, and Water Source Heat Pumps.

1. Software

   a. To meet the sequence of operation for each zone control, the controller shall use programs developed and tested by the controller manufacturer that are either factory loaded or downloaded with service tool to the controller.

   b. Stand-Alone Operation: Each piece of equipment specified in section A shall be controlled by a single controller and provide stand-alone control in the event of communication failure. In case of communications failure stand-alone operation shall use default values or last values for remote sensors read over the network such as outdoor air temperature.

   c. For controlling ancillary devices and for flexibility to change to sequence of operation in the future, the controller shall be capable running custom programs written in a graphical programming language.

2. Environment Controller hardware shall be suitable for the anticipated ambient conditions:

   a. Storage: -55 to 203 ºF (-48 to 95ºC) and 5 to 95% Rh, non-condensing.

   b. Operating: -40 to 158 ºF (-40 to 70 ºC) and 5 to 95% Rh, non-condensing.

   c. Controllers used indoors shall be mounted in a NEMA 1 enclosure at a minimum

d. Controllers used outdoors and/or in wet ambient shall be mounted within NEMA 4 type waterproof enclosures, and shall be rated for operation at -40 F to 158 F [-40 C to 70 C].

3. Input/Output

a. For flexibility in selection and replacement of valves, the controllers shall be capable of supporting all of the following valve control types 0-10VDC, 0-5VDC, 4-20mA, 24VAC floating point, 24VAC - 2 position (Normally Open or Normally Closed).

b. For flexibility in selection and replacement of sensors, the controllers shall be capable of reading sensor input ranges of 0 to10V, 0 to 20mA, pulse counts, and 200 to 20Kohm.

c. For flexibility in selection and replacement of binary sensors, the controller shall support dry and wetted (24VAC) binary inputs.

d. For flexibility in selection and replacement devices, the controllers shall have binary output which are able to drive at least 12VA each.

e. For flexibility in selection and replacement of motors, the controller shall be capable of outputting 24VAC (binary output), DC voltage (0 to 10VDC minimum range) and PWM (in the 80 to 100 Hz range).

f. For future needs, any I/O that is unused by functionality of equipment control shall be available to be used by custom program on the controller and by another controller on the network.

g. For future expansion and flexibility, the controller shall have either on board or through expansion, 50 hardware input/output points. Expansion points must communicate with the controller via an internal communications bus. Expansion points must be capable of being mounted up to 200 meters from the controller. Expansion points that require the BACnet network for communication with the controller are not allowed.

4. Serviceability. The controller shall provide the following in order to improve serviceability of the controller:

a. Diagnostic LEDs shall indicate correct operation or failures/faults for all the following: power, sensors, BACnet communications, and I/O communications bus.

b. All binary output shall have LED's indicating the output state.

c. All wiring connections shall removable without the use of a tool.

d. Software service tool connection through all of the following methods: direct cable connection to the controller, connection through another controller on BACnet link and through the controller's zone sensor.

e. For safety purposes, the controller shall be capable of being powered by a portable computer for the purposes of configuration, programming, and testing programs so that this work can be accomplished with the power off to the equipment.

f. Capabilities to temporarily override of BACnet point values with built-in time expiration in the controller.

g. BACnet Mack Address shall be set using decimal (0-9) based rotary switches.

h. Configuration change shall not be made in a programming environment, but rather by a configuration page utilizing dropdown list, check boxes, and numeric boxes.

i. BACnet trending objects resident on controller

1) Minimum of 20,000 trending points total on controller

2) Shall be capable of trending all BACnet points used by controller

3) Shall be capable of 1 second sample rates on all points

j. Software Retention. All Zone Controller operating parameters, setpoints, BIOS, and sequence of operation code must be stored in non-volatile memory in order to maintain such information for months without power.

k. Transformer for the controller must be rated at minimum of 115% of ASC power consumption, and shall be fused or current limiting type. 24 VAC, +/- 15% nominal, 50-60 Hz, 24 VA plus binary output loads, for a maximum of 12 VA for each binary output.

l. Agency Approval. The controller shall have Agency Compliance:

1) UL916 PAZX, Open Energy Management Equipment

2) UL94-5V, Flammability

3) FCC Part 15, Subpart B, Class B Limit

2.9 AUXILIARY CONTROL DEVICES

A. Motorized dampers and actuators shall be provided by ATC Contractor.

B. Provide all automatic dampers not specified elsewhere in the Specifications. These dampers shall be of heavy gauge steel construction, tight shutoff type, with replaceable elastomer seals along the blade edges and damper frames. These dampers are standard size dampers, to be installed by the Mechanical Contractor. Dampers maximum leakage rate shall be 3 CFM/ft^2 at 1-inch water gauge.

C. Electric Damper Actuators

1. The actuator shall have electronic overload or digital rotation sensing circuitry to prevent damage to the actuator throughout the rotation of the actuator.

2. Where shown, for power-failure/safety applications, an internal mechanical, spring return mechanism shall be built into the actuator housing.

3. All rotary spring return actuators shall be capable of both clockwise or counter clockwise spring return operation. Linear actuators shall spring return to the retracted position.

4. Proportional actuators shall accept a 0-10 VDC or 0-20 ma control signal and provide a 2-10 VDC or 4-20 ma operating range.

5. All non-spring return actuators shall have an external manual gear release to allow manual positioning of the damper when the actuator is not powered. Spring return actuators with more than 60 in-lb. torque capacity shall have a manual crank for this purpose.

6. Actuators shall be provided with a conduit fitting and a minimum 1m electrical cable and shall be pre-wired to eliminate the necessity of opening the actuator housing to make electrical connections.

7. Actuators shall be Underwriters Laboratories Standard 873 listed.

8. Actuators shall be designed for a minimum of 60,000 full stroke cycles at the actuator's rated torque.

D. Binary Temperature Devices

1. Low-Voltage Space Thermostats shall be 24 V, bimetal-operated, mercury-switch type, with either adjustable or fixed anticipation heater, concealed setpoint adjustment, 55°F-85°F setpoint range, 2°F maximum differential, and vented cover.

2. Line-Voltage Space Thermostats shall be bimetal-actuated, open-contact type or bellows-actuated, enclosed, snap-switch type or equivalent solid-state type, with heat anticipator, UL listing for electrical rating, concealed setpoint adjustment, 55°F-85°F setpoint range, 2°F maximum differential, and vented cover.

3. Low-Limit airstream thermostats shall be UL listed, vapor pressure type. Element shall be at least 20 ft long. Element shall sense temperature in each 1 ft section and shall respond to lowest sensed temperature. Low-limit thermostat shall be manual reset only.

E. Temperature Sensors

1. Temperature sensors shall be Resistance Temperature Device (RTD) or Thermistor.
2. Duct sensors shall be rigid or averaging as shown. Averaging sensors shall be a minimum of 5 feet in length.
3. Space sensors shall be equipped with set-point adjustment wheel, override switch, and/or communication port as shown on the drawings.
4. Wireless Zone Sensors
   a. Space sensors shall be equipped with set-point adjustment, override switch, and/or communication port as shown on the drawings.
   b. To check for proper operation, wireless zone temperature sensors shall include a signal strength and battery condition indicators using LED's under cover on non-display models
   c. The wireless zone sensor shall include a readily visual indication of battery condition. The battery indication lights shall flash periodically for a minimum of 5 days to indicate the need for battery replacement prior to failure.
   d. Zone sensor shall utilize AA batteries and have published battery life of a minimum 5 years. If OEM zone sensor batteries are only available from vendor, then vendor must supply spare set of batteries. In addition, if minimum published battery life is less than 5 years then vendor must supply replacement batteries to achieve 5 years of battery replacement cost avoidance.
   e. Provide matched temperature sensors for differential temperature measurement. Differential accuracy shall be within 0.2 F.

F. Low Limit Thermostats

1. Safety low limit thermostats shall be vapor pressure type with an element 6m [20 ft] minimum length. Element shall respond to the lowest temperature sensed by any one-foot section.
2. Low limit shall be manual reset only.

G. Carbon Dioxide (CO_2) Sensors

1. Carbon Dioxide sensors shall measure CO_2 in PPM in a range of 0-2000 ppm. Accuracy shall be +/- 3% of reading with stability within 5% over 5 years. Sensors shall be duct or space mounted as indicated in the sequence of operation.

H. Relays

1. Control relays shall be UL listed plug-in type with dust cover. Contact rating, configuration, and coil voltage suitable for application.
2. Time delay relays shall be UL listed solid-state plug-in type with adjustable time delay. Delay shall be adjustable plus or minus 200% (minimum) from set-point shown on plans. Contact rating, configuration, and coil voltage suitable for application. Provide NEMA 1 Type enclosure when not installed in local control panel.

I. Transformers and Power Supplies

1. Control transformers shall be UL listed, Class 2 current-limiting type, or shall be furnished with over-current protection in both primary and secondary circuits for Class 2 service.
2. Unit output shall match the required output current and voltage requirements. Current output shall allow for a 50% safety factor. Output ripple shall be 3.0 mV maximum Peak-to-Peak. Regulation shall be 0.10% line and load combined, with 50 microsecond response time for 50% load changes. Unit shall have built-in over-voltage protection.
3. Unit shall operate between 0 C and 50 C.
4. Unit shall be UL recognized.

5. Provide UPS back-up power supply for Building Automation System.

J. Current Switches

1. Current-operated switches shall be self-powered, solid state with adjustable trip current. The switches shall be selected to match the current of the application and output requirements of the DDC system.

2.10 LOCAL CONTROL PANELS

A. All indoor control cabinets shall be fully enclosed NEMA 1 Type construction with hinged door, and removable sub-panels or electrical sub-assemblies.

B. Interconnections between internal and face-mounted devices shall be pre-wired with color-coded stranded conductors neatly installed in plastic troughs and/or tie-wrapped. Terminals for field connections shall be UL listed for 600-volt service, individually identified per control/interlock drawings, with adequate clearance for field wiring. Control terminations for field connection shall be individually identified per control drawings.

C. Provide on/off power switch with over-current protection for control power sources to each local panel.

PART 3 – EXECUTION

3.1 PART INCLUDES

A. Examination

B. General Workmanship

C. Wiring

D. Installation of Sensors

E. Damper Actuator Installation

F. Identification of Hardware and Wiring

G. BAS DDC Controllers

H. Programming

I. Cleaning

J. Protection

K. Training

L. Field Quality Control

M. Acceptance

3.2 EXAMINATION

A. The Contract Documents shall be thoroughly examined for coordination of control devices their installation, wiring, and commissioning. Coordinate and review mechanical equipment specifications, locations, and identify any discrepancies, conflicts, or omissions that shall be reported to the Architect/Engineer for resolution before rough-in work is started.

B. The BAS manufacturer shall inspect the jobsite in order to verify that control equipment can be installed as required, and any discrepancies, conflicts, or omissions shall be reported to the Architect/Engineer for resolution before rough-in work is started.

3.3 GENERAL WORKMANSHIP

A. Install equipment, piping, wiring/conduit, parallel to building lines (i.e. horizontal, vertical, and parallel to walls) wherever possible.

B. Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.

C. Install all equipment in readily accessible location as defined by National Electric Code (NEC). Control panels shall be attached to structural walls or properly supported in a free-standing configuration, unless mounted in equipment enclosure specifically designed for that purpose. Panels shall be mounted to allow for unobstructed access for service.

D. Verify integrity of all control wiring to ensure continuity and freedom from shorts and grounds prior to commencing the startup and commissioning procedures.

E. All control device installation, and wiring shall comply with Contract Documents, acceptable industry specifications, and industry standards for performance, reliability, and compatibility. Installation and wiring shall be executed in strict adherence to local codes and standard practices referenced in Contract Documents.

3.4 WIRING

A. All control and interlock wiring shall comply with the National, Local Electrical Codes, and Section 260500 of these Contract Document specifications. Where the requirements of this section differ with those in Section 260500, the requirements of this section shall take precedence.

B. Where Class 2 wires are in concealed and accessible locations; including ceiling return air plenums, approved cables outside of electrical raceway can be used provided that the following conditions are met:

1. Circuits meet NEC Class 2 (current limited) requirements. (Low voltage power circuits shall be sub fused when required to meet Class 2 current limit.

2. All cables shall be UL listed for application (i.e., cables used in ceiling plenums shall be UL listed specifically for that purpose).

C. Do not install Class 2 wiring in conduits containing Class 1 wiring. Boxes and panels containing high voltage may not be used for low voltage wiring except for the purpose of interfacing the two via control relays and transformers.

D. Where Class 2 wiring is run exposed, wiring shall be run parallel along a surface or perpendicular to it, and bundled, using approved wire ties at no greater than 10 ft intervals. Such bundled cable shall be fastened to the structure, using industry approved fasteners, at 5 ft intervals or more often to achieve a neat and workmanlike result.

E. All wire-to-device connections shall be made at a terminal blocks or terminal strip. All wire-to wire connections shall be at a terminal block, or with a crimped connector. All wiring within enclosures shall be neatly bundled and anchored to permit access and prevent restriction to devices and terminals.

F. Maximum allowable voltage for control wiring shall be 120Vac. If only higher voltages are available for use, the BAS manufacturer shall provide step-down transformers to achieve the desired control voltages.

G. All control wiring shall be installed as continuous lengths, where possible. Any required splices shall be made only within an approved junction box or other approved protective device.

H. Install plenum wiring in sleeves where it passes through walls and floors. Maintain fire rating at all penetrations in accordance with Contract Documents and National and/or Local Codes.

I. Conduit and wire sizing shall be determined by the BAS manufacturer in order to maintain manufacturer's recommendation and must meet National and Local Codes.

J. Control and status relays are to be located in pre-fabricated enclosures that meet the application. These relays may also be located within packaged equipment control panel enclosures as coordinated. These relays shall not be located within Class 1 starter enclosures.

K. Follow manufacturer's installation recommendations for all communication and network bus cabling. Network or communication cabling shall be run separately from all control power wiring.

L. Adhere to Electrical Specification Requirements for installation of electrical raceways.

M. BAS manufacturer shall terminate all control and/or interlock wiring and shall maintain updated (as built) wiring diagrams with terminations identified at the job site.

N. Flexible metal conduits and liquid tight flexible metal conduits shall not exceed 3' in length and shall be supported at each end. Flexible metal conduit less than 1/2" electrical trade size shall not be used. In areas exposed to moisture, including chiller and boiler rooms, liquid tight, flexible metal conduits shall be used.

3.5 INSTALLATION OF SENSORS

A. All thermostats, humidistats, temperature sensors, etc., shall be mounted 5’-0” above finished floor.

B. Sensors required for mechanical equipment operation shall be factory installed and wired as specified in mechanical equipment specifications. BAS manufacturer shall be responsible for coordinating these control devices and ensuring the sequence of operations will be met. Installation and wiring shall be in accordance with the BAS manufacturer's recommendations.

C. Sensors that require field mounting shall meet the BAS manufacturer’s recommendations and be coordinated with the mechanical equipment they will be associated.

D. Mount sensors rigidly and adequately for the environment the sensor will operate.

E. Room temperature sensors shall be installed on concealed junction boxes properly supported by the block wall framing. For installation in dry wall ceilings, the low voltage sensor wiring can be installed exposed in the wall and must meet applicable National and Local Electrical Codes.

F. All wires attached to wall mounted sensors shall be sealed off to prevent air from transmitting in the associated conduit and affecting the room sensor readings.

G. Install duct static pressure tap with tube end facing directly down-stream of air flow.

H. Install space static pressure sensor with static sensing probe applicable for space installation where applicable.

I. Sensors used in mixing plenums, and hot and cold decks shall be of the averaging type. Averaging sensors shall be installed in a serpentine manner horizontally across duct. Each bend shall be supported with a capillary clip.

J. All pipe mounted temperature sensors shall be installed in matched thermowells. Install all liquid temperature sensors with heat conducting fluid in thermal wells for adequate thermal conductance.

K. Wiring for space sensors shall be concealed in building drywall. EMT conduit is acceptable within mechanical equipment and service rooms.

L. Install outdoor air temperature sensors on north wall complete with sun shield at manufacturer’s recommended location and coordinated with Engineer.

3.6 DAMPER ACTUATOR INSTALLATION

A. Mount and link multiple control damper actuators where required, per manufacturer's instructions.

B. To compress seals when spring-return actuators are used on normally closed dampers, power the actuator to approximately 5° open position, manually close the damper, and then tighten the linkage.

C. Check operation of damper/actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed positions. Coordinate any installation problems with Sheet Metal Contractor.

3.7 IDENTIFICATION OF HARDWARE AND WIRING

A. All field wiring and cabling, including that within factory mounted, and wired control panels and devices for mechanical equipment, shall be labeled at each end within 2" of termination with a cable identifier and other descriptive information for troubleshooting, maintenance, and service purposes. BAS manufacturer to coordinate this labeling requirement with mechanical equipment manufacturer as it relates to controls.

B. Permanently label or code each point of field terminal strips to show the instrument or item served and correlate them to the BAS design drawings.

C. Identify control panels with minimum 1-cm letters on laminated plastic nameplates.

D. Identifiers shall match record documents. All plug-in components shall be labeled such that removal of the component does not remove the label.

3.8 BAS DDC CONTROLLERS

A. Provide a separate DDC Controller for individual HVAC mechanical equipment. DDC Controllers shall be factory mounted, installed, and wired by mechanical equipment manufacturer as specified. BAS manufacturer to furnish and coordinate DDC controllers and control devices and ensure that installation and wiring adhere to BAS manufacturer's design recommendations. For those mechanical equipment units that do not have factory installed controls specified, the BAS manufacturer shall field mount controls and coordinate all installation and termination information to ensure the specified sequence of operations are met.

B. Building Controllers and Custom Application Controllers shall be selected to provide a minimum of 15% spare I/O point capacity for each point type (analog or digital) found at each location. If input points are not universal, 15% of each type is required. If outputs are not universal, 15% of each type is required. A minimum of one spare is required for each type of point used in each controller.

C. Future use of spare I/O point capacity shall require providing the field instrument and control device, field wiring, engineering, programming, and commissioning. No additional Controller boards or point modules shall be required to implement use of these spare points.

3.9 PROGRAMMING

A. Provide sufficient internal memory for all controllers to ensure specified sequence of operations, alarming, trending, and reporting requirements are achieved. BAS manufacturer shall provide a minimum of 25% spare memory capacity for future use.

B. Point Naming: System point names shall be modular in design, allowing easy operator interface without the use of a written point index.

C. Software Programming:

1. Provide programming for individual mechanical systems to achieve all aspects of the sequence of operation specified. It is the BAS manufacturer's responsibility to ensure all mechanical equipment functions and operates as specified in sequence of operations. Provide sufficient programming comments in controller application software to clearly describe each section of the program. The comment statements shall reflect the language used in the sequence of operations.

D. BAS Operator's Interface:

1. When Operator Workstation is specified, provide color graphics for each piece of mechanical equipment depicting sufficient I/O to monitor and troubleshoot operation. Additionally, provide individual floor plans of the building allowing an operator to quickly view the overall floor plan area for any out of tolerance conditions that may need addressing. Operator color graphics shall include Rooftop Units, Exhaust Fans, etc. These standard graphics shall depict all points dynamically as specified in the points list and/or indicated in sequence of operation.

2. The BAS manufacturer shall provide all the labor necessary to install, initialize, start up, and trouble-shoot all operator interface software and their functions as described in this section. This includes any operating system software, the operator interface data base, and any third-party software installation and integration required for successful operation of the operator interface.

3.10 CLEANING

A. The BAS manufacturer's installing contractor(s) shall clean up all debris resulting from their installation activities on a daily basis. The installation contractors shall remove all cartons, containers, crates, etc. under his control as soon as their contents have been removed. Waste shall be collected and placed in a location designated by the Owner, Construction Manager, General Contractor, and/or Mechanical Contractor.

B. At the completion of work in any area, the installation contractor shall clean all of their work, equipment, etc., making it free from dust, dirt and debris.

C. At the completion of work, all equipment furnished under this Section shall be checked for paint damage. Any factory finished paint that has been damaged shall be repaired to match the adjacent areas. Any metal cabinet or enclosure that has been deformed shall be replaced with new material and repainted to match the adjacent areas.

3.11 PROTECTION

A. The BAS installation contractor shall protect all work and material from damage by their work or personnel, and shall be liable for all damage.

B. The BAS manufacturer shall be responsible for their work and equipment until final inspection, testing, and acceptance. The BAS installing contractor shall protect their work against theft or damage, and shall carefully store material and equipment received on site that is not immediately installed. The Contractor shall close all open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.

3.12 TRAINING

A. Provide minimum of (2) on-site training sessions, and (4) hours for each session, throughout the contract period. The training will be provided for personnel designated by the Owner.

B. The Owner training shall enable personnel to proficiently operate the BAS by being able to create, modify and delete programming; add, remove and modify physical points for individual controllers; and add additional controllers when required.

C. These objectives will be divided into three logical groupings; participants may attend one or more of these, depending on level of knowledge required:

1. Day-to-day BAS Operators
2. BAS Troubleshooting & Maintenance
3. Maintenance Manager: Parts Inventory

D. Provide course outline and materials prior to schedule training session. The instructor(s) shall provide one copy of training material per student.

E. The instructor(s) shall be factory-trained and experienced in teaching this technical material.

3.13 FIELD QUALITY CONTROL

A. All work, materials and equipment shall comply with the rules and regulations of applicable local, state, and federal codes and ordinances as identified in Contract Documents.

B. BAS manufacturer shall continually monitor the field installation for building code compliance and quality of workmanship. All visible piping and or wiring runs shall be installed parallel to building lines and properly supported.

C. BAS installing Contractor(s) shall arrange for field inspections by local and/or state authorities having jurisdiction over the work.

3.14 ACCEPTANCE

A. The BAS will not be accepted as meeting the requirements of Completion until all tests described in this specification have been performed to the satisfaction of both the Engineer and Owner. Any tests that cannot be performed due to circumstances beyond the control of the Contractor may be exempt from the Completion requirements if stated as such in writing by the Owner's representative. Such tests shall then be performed as part of the warranty.

END OF SECTION

SECTION 230993.11
SEQUENCE OF OPERATIONS FOR HVAC DDC

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes control sequences for DDC for HVAC systems, subsystems, and equipment.

B. Related Requirements:

1. Section 230923 "DDC Systems for HVAC" for control equipment.

PART 2 - SEQUENCE OF OPERATIONS

2.1 VARIABLE AIR VOLUME ROOFTOP UNITS:

A. Building Automation System Interface:

1. The Building Automation System (BAS) shall send the controller Occupied Bypass, Morning Warm-up / Pre-Cool, Occupied / Unoccupied and Heat / Cool modes. If a BAS is not present, or communication is lost with the BAS the controller shall operate using default modes and setpoints.

B. Occupied Mode:

1. During occupied periods, the supply fan shall run continuously and the outside air damper shall open to maintain minimum ventilation requirements. The unit controller shall control the supply fan speed to maintain the current duct static pressure setpoint (adj.). DX cooling and gas heat shall stage to maintain the current discharge air temperature setpoint. If economizing is enabled the outside air damper shall modulate to maintain the current discharge air temperature setpoint.

C. Unoccupied Mode:

1. When the space temperature is below the unoccupied heating setpoint of 60.0 deg. F (adj.) the supply fan shall start, the outside air damper shall remain closed and the gas heat shall be enabled. When the space temperature rises above the unoccupied heating setpoint of 60.0 deg. F (adj.) plus the unoccupied differential of 4.0 deg. F (adj.) the supply fan shall stop and the gas heat shall be disabled.

2. When the space temperature is above the unoccupied cooling setpoint of 85.0 deg. F (adj.) the supply fan shall start, the outside air damper shall open if economizing is enabled and remain closed if economizing is disabled and the DX cooling shall be enabled. When the space temperature falls below the unoccupied cooling setpoint of 85.0 deg. F (adj.) minus the unoccupied differential of 4.0 deg. F (adj.) the supply fan shall stop, the DX cooling shall be disabled and the outside air damper shall close.

D. Optimal Start:

1. The BAS shall monitor the scheduled occupied time, occupied space setpoints and space temperature to calculate when the optimal start occurs.

E. Morning Warm-Up Mode:

1. During optimal start, if the average space temperature is below the occupied heating setpoint a morning warm-up mode shall be activated. When morning warm-up is initiated, the unit shall enable the heating and supply fan. The outside air damper shall remain closed. When the average space temperature reaches the occupied heating setpoint (adj.), the unit shall transition to the occupied mode.

F. Pre-Cool Mode:

1. During optimal start, if the average space temperature is above the occupied cooling setpoint, pre-cool mode shall be activated. When pre-cool is initiated, the unit shall enable the fan and cooling or economizer. The outside air damper shall remain closed, unless economizing. When the average space temperature reaches occupied cooling setpoint (adj.), the unit shall transition to the occupied mode.

G. Occupied Bypass**:**

1. The BAS shall monitor the status of the “on” and “cancel” buttons of the space temperature sensors. When an occupied bypass request is received from a space sensor, the unit shall transition from its current occupancy mode to occupied bypass mode and the unit shall maintain the space temperature to the occupied setpoints (adj.).

H. Economizer:

1. The supply air sensor shall measure the dry bulb temperature of the air leaving the evaporator coil while economizing. When economizing is enabled and the unit is operating in the cooling mode, the economizer damper shall be modulated between its minimum position and 100% to maintain the discharge air temperature setpoint. The economizer damper shall modulate toward minimum position in the event the discharge air temperature falls below the discharge low limit temperature setpoint. Compressors shall be delayed from operating until the economizer has opened to 100%.

I. Comparative Enthalpy:

1. Outside air (OA) enthalpy shall be compared with Return air (RA) enthalpy point. The economizer shall enable when OA enthalpy is less than RA enthalpy - 3.0 BTU/LB. The economizer shall disable when OA enthalpy is greater than RA enthalpy.

J. Smoke Detector Shutdown: The unit shall shut down in response to a signal from either smoke detector indicating the presence of smoke. The smoke detectors shall be interlocked to the unit through the dry contacts of the smoke detectors. A manual reset of the smoke detectors shall be required to restart the unit.

K. Filter Status:

1. A differential pressure switch shall monitor the differential pressure across the filter when the fan is running. If the switch closes for 2 minutes after a request for fan operation a dirty filter alarm shall be annunciated at the BAS.

2.2 VAV BOXES WITH ELECTRIC REHEAT

A. Building Automation System Interface:

1. The Building Automation System (BAS) shall send the controller Occupied and Unoccupied commands. The BAS may also send a Heat/Cool mode, priority shutdown commands, space temperature and/or space temperature setpoint. If communication is lost with the BAS, the VAV controller shall operate using its local setpoints.

B. Occupancy Mode:

1. The occupancy mode shall be communicated or hardwired to the controller via a binary input. Valid occupancy modes for the unit shall be:

C. Occupied:

1. Normal operating mode for occupied spaces or daytime operation. When the unit is in the occupied mode the VAV shall maintain the space temperature at the active occupied heating or cooling setpoint. Applicable ventilation and airflow setpoints shall be enforced. The occupied mode shall be the default mode of the VAV.

D. Unoccupied:

1. Normal operating mode for unoccupied spaces or nighttime operation. When the unit is in unoccupied mode the VAV controller shall maintain the space temperature at the stored unoccupied heating or cooling setpoint regardless of the presence of a hardwired or communicated setpoint. When the space temperature exceeds the active unoccupied setpoint the VAV shall modulate fully closed.

E. Occupied Bypass:

1. Mode used to temporarily place the unit into the occupied operation. Tenants shall be able to override the unoccupied mode from the space sensor. The override shall last for a maximum of 4 hours (adj.). The tenants shall be able to cancel the override from the space sensor at any time. During the override the unit shall operate in occupied mode.

F. Heat/Cool Mode:

1. The Heat/Cool mode shall be set by a communicated value or automatically by the VAV. In standalone or auto mode the VAV shall compare the primary air temperature with the configured auto changeover setpoint to determine if the air is "hot" or "cold". Heating mode it implies the primary air temperature is hot. Cooling mode it implies the primary air temperature is cold.

G. Heat/Cool Setpoint:

1. The space temperature setpoint shall be determined either by a local (e.g., thumbwheel) setpoint, the VAV default setpoint or a communicated value. The VAV shall use the locally stored default setpoints when neither a local setpoint nor communicated setpoint is present. If both a local setpoint and communicated setpoint exist, the VAV shall use the communicated value.

H. Heating Mode:

1. When the unit is in heating mode, the VAV controller shall maintain the space temperature at the active heating setpoint by modulating the airflow between the active heating minimum airflow setpoint to the maximum heating airflow setpoint. Based on the VAV controller occupancy mode, the active heating setpoint shall be one of the following:

Setpoint	**Default Value**
Occupied Heating Setpoint	71.0 deg. F
Unoccupied Heating Setpoint	60.0 deg. F
Occupied Standby Heating Setpoint	67.0 deg. F
Occupied Min Heating Airflow Setpoint	See VAV Schedule
Occupied Max Heating Airflow Setpoint	See VAV Schedule

2. The VAV controller shall use the measured space temperature and the active heating setpoint to determine the requested heating capacity of the unit. The outputs will be controlled based on the unit configuration and the requested heating capacity.

I. Reheat Control:

1. Reheat will only be allowed when the primary air temperature is 5.0 deg. F below the configured reheat enable setpoint of 70.0 deg. F (adj.). The reheat shall be enabled when the space temperature drops below the active heating setpoint and the minimum airflow requirements are met. During reheat the VAV shall operate as follows:

J. Silicon Controlled Rectifier (SCR):

1. If the space temperature is at the heating setpoint, the electric heater shall modulate as required to maintain space temperature at the active heating setpoint while the VAV operates at its minimum heating airflow setpoint. If the discharge air temperature reaches the design heating discharge air temperature setpoint (adj.), the VAV shall modulate airflow between the minimum heating airflow setpoint and the maximum heating airflow setpoint as required to maintain space temperature at the active heating setpoint, while the electric heater modulates to maintain discharge air temperature at the design heating discharge air temperature setpoint. If the airflow reaches the maximum heating airflow setpoint, the VAV shall modulate the electric heater as required to maintain space temperature at the active heating setpoint, while the VAV operates at its maximum heating airflow setpoint.

K. Space Sensor Failure:

1. If there is a fault with the operation of the zone sensor an alarm shall be annunciated at the BAS. Space sensor failure shall cause the VAV to drive the damper to minimum air flow if the VAV is in the occupied mode, or drive it closed if the VAV is in the unoccupied mode.

L. Cooling Mode:

1. When the unit is in cooling mode, the VAV controller shall maintain the space temperature at the active cooling setpoint by modulating the airflow between the active cooling minimum airflow setpoint to the maximum cooling airflow setpoint. Based on the VAV controller occupancy mode, the active cooling setpoint shall be one of the following:

Setpoint	**Default Value**
Occupied Cooling Setpoint	74.0 deg. F
Unoccupied Cooling Setpoint	85.0 deg. F
Occupied Standby Cooling Setpoint	78.0 deg. F
Occupied Min Cooling Airflow Setpoint	See VAV Schedule
Occupied Max Cooling Airflow Setpoint	See VAV Schedule

2. The VAV shall use the measured space temperature and the active cooling setpoint to determine the requested cooling capacity of the unit. The outputs will be controlled based on the unit configuration and the requested cooling capacity.

2.1 PROCESS AREA (100% OUTSIDE AIR) CONSTANT VOLUME ROOFTOP UNITS:

A. Building Automation System Interface:

1. The Building Automation System (BAS) shall send the controller Morning Warm-up / Pre-Cool, Occupied / Unoccupied and Heat / Cool modes. If a BAS is not present, or communication is lost with the BAS the controller shall operate using default modes and setpoints.

B. Occupied Mode:

1. During occupied periods, the supply fan shall run continuously and the outside air damper shall open. DX cooling and gas heat shall stage to maintain the current space temperature setpoint.

C. Unoccupied Mode:

1. When the space temperature is below the unoccupied heating setpoint of 55.0 deg. F (adj.) the supply fan shall start, the outside air damper shall open and the gas heat shall be enabled. When the space temperature rises above the unoccupied heating setpoint of 55.0 deg. F (adj.) plus the unoccupied differential of 4.0 deg. F (adj.) the supply fan shall stop and the gas heat shall be disabled.

D. Optimal Start:

1. The BAS shall monitor the scheduled occupied time, occupied space setpoints and space temperature to calculate when the optimal start occurs.

E. Smoke Detector Shutdown: The unit shall shut down in response to a signal from either smoke detector indicating the presence of smoke. The smoke detectors shall be interlocked to the unit through the dry contacts of the smoke detectors. A manual reset of the smoke detectors shall be required to restart the unit.

F. Filter Status: A differential pressure switch shall monitor the differential pressure across the filter when the fan is running. If the switch closes for 2 minutes after a request for fan operation a dirty filter alarm shall be annunciated at the BAS.

2.4 EXHAUIST FANS and INTAKE LOUVERS IN PROCESS ARES:

A. Provide an exhaust fan control panel on the wall of Area 1 near the entry from the Administration Area. Whenever an exhaust fan is indexed to ON it's associated intake louver shall open and vice versa. Provide pushbutton control on the panel board to allow for the following:

AREA 1 (existing Fiber Tipping): Fans shall operate in unison and be on/off and set to run continuously whenever indexed ON.

AREA 2 (existing Sorting): Fans shall have two speed settings (high/summer and low/winter). Fans shall operate in unison at the speed determined at the control panel and run continuously whenever indexed to high or low speed.

AREA 4 (new Tipping): Fans shall operate in unison and be on/off and set to run continuously whenever indexed ON.

AREA 5: (new Bale Storage): Fans shall have two speed settings (high/summer and low/winter). Fans shall operate in unison at the speed determined at the control panel and run continuously whenever indexed to high or low speed.

B. All Fans and louvers shall be monitored by the BMS for status of operation and position respectively.

C. Exhaust fans shall be interlocked with fire alarm system and shut down upon fire alarm activation.

2.5 UNIT HEATERS IN PROCESS AREAS:

A. The DDC controller shall control the unit heater to maintain space temperature set points (adjustable). When the space temperature is below the heating set point, the unit heater fans and gas heating section shall be enabled.

2.6 RADIANT TUBE HEATERS

A. Through DDC, the space temperature sensor shall enable the radiant tube heater to maintain occupied space temperature. Occupied-unoccupied modes shall be determined by the BMS.

2.7 SPLIT SYSTEM AC UNIT:

A. The system shall be controlled by the unit manufacturer's space thermostat. The BMS contractor shall install and wire thermostat.

B. The BMS contractor shall provide the low voltage control interlock wiring between indoor and outdoor units.

C. The BMS contractor shall wire the unit manufacturer provided remote alarm contact to the BMS.

D. The BMS contractor shall monitor the space temperature in each room for alarming during abnormal conditions. Consult owner for alarm parameters. The system shall be controlled from the DDC controller at each unit. It shall provide all control functions.

2.8 TOILET/GENERAL EXHAUST FANS:

A. Exhaust fan shall be interlocked with the operation of the rooftop unit so as to run whenever in the Occupied mode.

2.9 MECHANICAL ROOM HEATING / EXHAUST:

A. Room heating/cooling thermostat shall control system operation.

B. Exhaust fan shall start and intake louver damper shall open on a call for cooling.

C. Unit heater shall operate on a call for heating.

PART 3 -EXECUTION (Not Applicable)

END OF SECTION

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SECTION 231123
FACILITY NATURAL-GAS 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. Pipes, tubes, and fittings.
2. Piping specialties.
3. Piping and tubing joining materials.
4. Manual gas shutoff valves.
5. Motorized gas valves.
6. Pressure regulators.
7. Dielectric fittings.

1.3 DEFINITIONS

A. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of the following:

1. Piping specialties.
2. Corrugated, stainless-steel tubing with associated components.
3. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
4. Pressure regulators. Indicate pressure ratings and capacities.
5. Dielectric fittings.

1.5 QUALITY ASSURANCE

A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.

B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.

D. Protect stored PE pipes and valves from direct sunlight.

1.7 PROJECT CONDITIONS

A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Minimum Operating-Pressure Ratings:

1. Piping and Valves: 100 psig minimum unless otherwise indicated.
2. Service Regulators: 100 psig minimum unless otherwise indicated.

B. Natural-Gas System Pressure within Buildings: 0.5 psig or less.

2.2 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A53/A53M, black steel, Schedule 40, Type E or S, Grade B.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
2. Wrought-Steel Welding Fittings: ASTM A234/A234M for butt welding and socket welding.
3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
   a. Material Group: 1.1.
   b. End Connections: Threaded or butt welding to match pipe.
   c. Lapped Face: Not permitted underground.
   d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
   e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless-steel underground.
5. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.
   a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.
6. Mechanical Couplings:
   a. Stainless Steel flanges and tube with epoxy finish.
   b. Buna-nitrile seals.
   c. Stainless Steel bolts, washers, and nuts.
   d. Coupling shall be capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
   e. Steel body couplings installed underground on plastic pipe shall be factory equipped with anode.

B. Corrugated, Stainless-Steel Tubing: Comply with ANSI/IAS LC 1.

1. Tubing: ASTM A240/A240M, corrugated, Series 300 stainless steel.

2. Coating: PE with flame retardant.
    a. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
        1) Flame-Spread Index: 25 or less.
        2) Smoke-Developed Index: 50 or less.
3. Fittings: Copper-alloy mechanical fittings with ends made to fit and listed for use with corrugated stainless-steel tubing and capable of metal-to-metal seal without gaskets. Include brazing socket or threaded ends complying with ASME B1.20.1.
4. Striker Plates: Steel, designed to protect tubing from penetrations.
5. Manifolds: Malleable iron or steel with factory-applied protective coating. Threaded connections shall comply with ASME B1.20.1 for pipe inlet and corrugated tubing outlets.

2.3 PIPING SPECIALTIES

A. Appliance Flexible Connectors:
    1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
    2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
    3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
    4. Corrugated stainless-steel tubing with polymer coating.
    5. Operating-Pressure Rating: 0.5 psig (3.45 kPa).
    6. End Fittings: Zinc-coated steel.
    7. Threaded Ends: Comply with ASME B1.20.1.
    8. Maximum Length: 72 inches (1830 mm.)
B. Quick-Disconnect Devices: Comply with ANSI Z21.41.
    1. Copper-alloy convenience outlet and matching plug connector.
    2. Nitrile seals.
    3. Hand operated with automatic shutoff when disconnected.
    4. For indoor or outdoor applications.
    5. Adjustable, retractable restraining cable.
C. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.4 JOINING MATERIALS

A. Joint Compound and Tape: Suitable for natural gas.
B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F (540 deg C) complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

2.5 MANUAL GAS SHUTOFF VALVES

A. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.

B. General Requirements for Metallic Valves, NPS 2 (DN 50) and Smaller: Comply with ASME B16.33.

1. CWP Rating: 125 psig (862 kPa).
2. Threaded Ends: Comply with ASME B1.20.1.
3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch (25 mm) and smaller.
6. Service Mark: Valves 1-1/4 inches (32 mm) to NPS 2 (DN 50) shall have initials "WOG" permanently marked on valve body.

C. General Requirements for Metallic Valves, NPS 2-1/2 (DN 65) and Larger: Comply with ASME B16.38.

1. CWP Rating: [125 psig (862 kPa)] <Insert pressure>.
2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
3. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
4. Service Mark: Initials "WOG" shall be permanently marked on valve body.

D. One-Piece, Bronze Ball Valve with Bronze Trim: MSS SP-110.

1. Body: Bronze, complying with ASTM B584.
2. Ball: Chrome-plated brass.
3. Stem: Bronze; blowout proof.
4. Seats: Reinforced TFE; blowout proof.
5. Packing: Separate packnut with adjustable-stem packing threaded ends.
6. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
7. CWP Rating: 600 psig (4140 kPa).
8. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

E. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.

1. Body: Bronze, complying with ASTM B584.
2. Ball: Chrome-plated bronze.
3. Stem: Bronze; blowout proof.
4. Seats: Reinforced TFE; blowout proof.
5. Packing: Threaded-body packnut design with adjustable-stem packing.
6. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
7. CWP Rating: 600 psig (4140 kPa).
8. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

F. Two-Piece, Regular-Port Bronze Ball Valves with Bronze Trim: MSS SP-110.

1. Body: Bronze, complying with ASTM B584.
2. Ball: Chrome-plated bronze.
3. Stem: Bronze; blowout proof.
4. Seats: Reinforced TFE.
5. Packing: Threaded-body packnut design with adjustable-stem packing.
6. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
7. CWP Rating: 600 psig (4140 kPa).
8. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

G. Bronze Plug Valves: MSS SP-78.

1. Body: Bronze, complying with ASTM B584.
2. Plug: Bronze.
3. Ends: Threaded, socket, or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
4. Operator: Square head or lug type with tamperproof feature where indicated.
5. Pressure Class: 125 psig (862 kPa).
6. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
7. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

H. Valve Boxes:

1. Cast-iron, two-section box.
2. Top section with cover with "GAS" lettering.
3. Bottom section with base to fit over valve and barrel a minimum of 5 inches (125 mm) in diameter.
4. Adjustable cast-iron extensions of length required for depth of bury.
5. Include tee-handle, steel operating wrench with socket end fitting valve nut or flat head, and with stem of length required to operate valve.

2.6 PRESSURE REGULATORS

A. General Requirements:

1. Single stage and suitable for natural gas.
2. Steel jacket and corrosion-resistant components.
3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2 (DN 50) and smaller; flanged for regulators NPS 2-1/2 (DN 65) and larger.

B. Service Pressure Regulators: Comply with ANSI Z21.80.

1. Body and Diaphragm Case: Cast iron or die-cast aluminum.
2. Springs: Zinc-plated steel; interchangeable.
3. Diaphragm Plate: Zinc-plated steel.
4. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.

5. Orifice: Aluminum; interchangeable.
6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
7. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
8. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
9. Overpressure Protection Device: Factory mounted on pressure regulator.
10. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
11. Maximum Inlet Pressure: 100 psig (690 kPa).

C. Line Pressure Regulators: Comply with ANSI Z21.80.
1. Body and Diaphragm Case: Cast iron or die-cast aluminum.
2. Springs: Zinc-plated steel; interchangeable.
3. Diaphragm Plate: Zinc-plated steel.
4. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
5. Orifice: Aluminum; interchangeable.
6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
7. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
8. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
9. Overpressure Protection Device: Factory mounted on pressure regulator.
10. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
11. Maximum Inlet Pressure: 2 psig (13.8 kPa).

D. Appliance Pressure Regulators: Comply with ANSI Z21.18.
1. Body and Diaphragm Case: Die-cast aluminum.
2. Springs: Zinc-plated steel; interchangeable.
3. Diaphragm Plate: Zinc-plated steel.
4. Seat Disc: Nitrile rubber.
5. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
6. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
7. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
8. Maximum Inlet Pressure: 2 psig (13.8 kPa).

2.7 SERVICE METERS

A. Diaphragm-Type Service Meters: Comply with ANSI B109.1.
1. Case: Die-cast aluminum.
2. Connections: Steel threads.
3. Diaphragm: Synthetic fabric.
4. Diaphragm Support Bearings: Self-lubricating.
5. Compensation: Continuous temperature and pressure.

6. Meter Index: Cubic feet.
7. Meter Case and Index: Tamper resistant.
8. Remote meter reader compatible.
9. Maximum Inlet Pressure: 100 psig (690 kPa).
10. Pressure Loss: Maximum 0.5-inch wg (124 Pa).
11. Accuracy: Maximum plus or minus 1.0 percent.

B. Rotary-Type Service Meters: Comply with ANSI B109.3.
1. Case: Extruded aluminum.
2. Connection: Flange.
3. Impellers: Polished aluminum.
4. Rotor Bearings: Self-lubricating.
5. Compensation: Continuous temperature.
6. Meter Index: Cubic feet.
7. Tamper resistant.
8. Remote meter reader compatible.
9. Maximum Inlet Pressure: 100 psig (690 kPa).
10. Accuracy: Maximum plus or minus 2.0 percent.

2.8 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. Description:
a. Standard: ASSE 1079.
b. Pressure Rating: 125 psig (860 kPa) minimum at 180 deg F (82 deg C).
c. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:
1. Description:
a. Standard: ASSE 1079.
b. Factory-fabricated, bolted, companion-flange assembly.
c. Pressure Rating: 125 psig (860 kPa) minimum at 180 deg F (82 deg C).
d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

2.9 LABELING AND IDENTIFYING

A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored yellow.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.

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

3.2 PREPARATION

A. Close equipment shutoff valves before turning off natural gas to premises or piping section.

B. Inspect natural-gas piping according to NFPA 54 to determine that natural-gas utilization devices are turned off in piping section affected.

C. Comply with NFPA 54 requirements for prevention of accidental ignition.

3.3 OUTDOOR PIPING INSTALLATION

A. Comply with NFPA 54 for installation and purging of natural-gas piping.

B. Install underground, natural-gas piping buried at least 36 inches (900 mm) below finished grade. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

1. If natural-gas piping is installed less than 36 inches (900 mm) below finished grade, install it in containment conduit.

C. Install underground, PE, natural-gas piping according to ASTM D2774.

D. Steel Piping with Protective Coating:

1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
3. Replace pipe having damaged PE coating with new pipe.

E. Copper Tubing with Protective Coating:

1. Apply joint cover kits over tubing to cover, seal, and protect joints.
2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.

F. Install fittings for changes in direction and branch connections.

G. Install pressure gage downstream from each service regulator. Pressure gages are specified in Section 230519 "Meters and Gages for HVAC Piping."

3.4 INDOOR PIPING INSTALLATION

A. Comply with NFPA 54 for installation and purging of natural-gas piping.

B. 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.

C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.

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. Locate valves for easy access.

H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.

I. Install piping free of sags and bends.

J. Install fittings for changes in direction and branch connections.

K. Verify final equipment locations for roughing-in.

L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.

M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.

   1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches (75 mm) long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

N. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.

O. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.

P. Concealed Location Installations: Except as specified below, install concealed natural-gas piping and piping installed under the building in containment conduit constructed of steel pipe with welded joints as described in Part 2. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.

   1. Above Accessible Ceilings: Natural-gas piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.

   2. In Floors: Install natural-gas piping with welded or brazed joints and protective coating in cast-in-place concrete floors. Cover piping to be cast in concrete slabs with minimum of 1-1/2 inches (38 mm) of concrete. Piping may not be in physical contact with other metallic structures such as reinforcing rods or electrically neutral conductors. Do not embed piping in concrete slabs containing quick-set additives or cinder aggregate.

   3. In Floor Channels: Install natural-gas piping in floor channels. Channels must have cover and be open to space above cover for ventilation.

   4. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.

      a. Exception: Tubing passing through partitions or walls does not require striker barriers.

   5. Prohibited Locations:

      a. Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.

      b. Do not install natural-gas piping in solid walls or partitions.

Q. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

R. Connect branch piping from top or side of horizontal piping.

S. Install unions in pipes NPS 2 (DN 50) and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.

T. Do not use natural-gas piping as grounding electrode.

U. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.

V. Install pressure gage downstream from each line regulator. Pressure gages are specified in Section 230519 "Meters and Gages for HVAC Piping."

W. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

X. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

Y. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

3.5 SERVICE-METER ASSEMBLY INSTALLATION

A. Install service-meter assemblies aboveground, on concrete bases.

B. Install metal shutoff valves upstream from service regulators. Shutoff valves are not required at second regulators if two regulators are installed in series.

C. Install strainer on inlet of service-pressure regulator and meter set.

D. Install service regulators mounted outside with vent outlet horizontal or facing down. Install screen in vent outlet if not integral with service regulator.

E. Install metal shutoff valves upstream from service meters. Install dielectric fittings downstream from service meters.

F. Install service meters downstream from pressure regulators.

G. Install metal bollards to protect meter assemblies. Comply with requirements in Section 055000 "Metal Fabrications" for pipe bollards.

3.6 VALVE INSTALLATION

A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.

B. Install underground valves with valve boxes.

C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

D. Install earthquake valves aboveground outside buildings according to listing.

E. Install anode for metallic valves in underground PE piping.

3.7 PIPING JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints:

1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
2. Cut threads full and clean using sharp dies.
3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
5. 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.

D. Welded Joints:

1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
2. Bevel plain ends of steel pipe.

3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.

F. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.

G. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.

H. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D2657.

1. Plain-End Pipe and Fittings: Use butt fusion.

2. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.8 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."

B. Comply with requirements for pipe hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

C. Install hangers for steel piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

D. Install hangers for corrugated stainless-steel tubing, 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 (300 mm) of each fitting.

F. Support vertical runs of steel piping to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

G. Support vertical runs of corrugated stainless-steel tubing to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.9 CONNECTIONS

A. Connect to utility's gas main according to utility's procedures and requirements.

B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.

C. Install piping adjacent to appliances to allow service and maintenance of appliances.

D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches (1800 mm) of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.

E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.10 LABELING AND IDENTIFYING

A. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for piping and valve identification.

B. Install detectable warning tape directly above gas piping, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

3.11 PAINTING

A. Comply with requirements in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting" for painting interior and exterior natural-gas piping.

B. Paint exposed, exterior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.

1. Alkyd System: MPI EXT 5.1D.

a. Prime Coat: Alkyd anticorrosive metal primer.

b. Intermediate Coat: Exterior alkyd enamel matching topcoat.

c. Topcoat: Exterior alkyd enamel flat.

d. Color: Gray.

C. Paint exposed, interior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.

1. Latex Over Alkyd Primer System: MPI INT 5.1Q.

a. Prime Coat: Alkyd anticorrosive metal primer.

b. Intermediate Coat: Interior latex matching topcoat.

c. Topcoat: Interior latex flat.

d. Color: Gray.

D. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.12 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Test, inspect, and purge natural gas according to NFPA 54 and authorities having jurisdiction.

C. Natural-gas piping will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.13 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain earthquake valves.

3.14 OUTDOOR PIPING SCHEDULE

A. Underground natural-gas piping shall be the following:

1. Steel pipe with wrought-steel fittings and welded joints, or mechanical couplings. Coat pipe and fittings with protective coating for steel piping.

B. Aboveground natural-gas piping shall be the following:

1. Steel pipe with malleable-iron fittings and threaded joints.

2. Steel pipe with wrought-steel fittings and welded joints.

C. Branch Piping in Cast-in-Place Concrete to Single Appliance: Annealed-temper copper tube with wrought-copper fittings and brazed joints. Install piping embedded in concrete with no joints in concrete.

D. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

3.15 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 5 PSIG (34.5 kPa)

A. Aboveground, branch piping NPS 1 (DN 25) and smaller shall be one of the following:

1. Corrugated stainless-steel tubing with mechanical fittings having socket or threaded ends to match adjacent piping.
2. Annealed-temper, tin-lined copper tube with flared joints and fittings.
3. Annealed-temper, copper tube with wrought-copper fittings and brazed joints.
4. Aluminum tube with flared fittings and joints.
5. Steel pipe with malleable-iron fittings and threaded joints.

B. Aboveground, distribution piping shall be one of the following:

1. Steel pipe with malleable-iron fittings and threaded joints.
2. Steel pipe with steel welding fittings and welded joints.
3. Drawn-temper copper tube with wrought-copper fittings and brazed joints.

C. Underground, below building, piping shall be one of the following:

1. Steel pipe with malleable-iron fittings and threaded joints.
2. Steel pipe with wrought-steel fittings and welded joints.

3.16 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Valves for pipe sizes NPS 2 (DN 50) and smaller at service meter shall be one of the following:

1. One-piece, bronze ball valve with bronze trim.
2. Two-piece, full-port, bronze ball valves with bronze trim.
3. Bronze plug valve.

B. Valves for pipe sizes NPS 2-1/2 (DN 65) and larger at service meter shall be one of the following:

1. Two-piece, full-port, bronze ball valves with bronze trim.
2. Bronze plug valve.
3. Cast-iron, nonlubricated plug valve.

C. Distribution piping valves for pipe sizes NPS 2 (DN 50) and smaller shall be one of the following:

1. One-piece, bronze ball valve with bronze trim.
2. Two-piece, full-port, bronze ball valves with bronze trim.
3. Bronze plug valve.

D. Distribution piping valves for pipe sizes NPS 2-1/2 (DN 65) and larger shall be one of the following:

1. Two-piece, full-port, bronze ball valves with bronze trim.
2. Bronze plug valve.

E. Valves in branch piping for single appliance shall be one of the following:

1. One-piece, bronze ball valve with bronze trim.
2. Two-piece, full-port, bronze ball valves with bronze trim.
3. Bronze plug valve.

END OF SECTION

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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-410A:

1. Suction Lines for Air-Conditioning Applications: 185 psig.
2. Hot-Gas and Liquid Lines: 325 psig.

1.3 SUBMITTALS

A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop based on manufacturer's test data.

B. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationships between piping and equipment.

1. Refrigerant piping indicated on Drawings is schematic only. Size piping and design actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.

C. Field quality-control test reports.

D. Operation and maintenance data.

1.4 QUALITY ASSURANCE

A. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."

B. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.5 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 280, Type ACR.

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: Non-rotating, 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 F.
6. Superheat: Adjustable.
7. Reverse-flow option (for heat-pump applications).
8. End Connections: Socket, flare, or threaded union.
9. Working Pressure Rating: 700 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 alumina.
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: 1.5 tons.
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 alumina.
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: 1.5 tons.
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 VALVE AND SPECIALTY APPLICATIONS

A. Install 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 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.

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

B. Install refrigerant piping according to ASHRAE 15.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping adjacent to machines to allow service and maintenance.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Refer to Division 23 Sections “Facility Management and Control System (FMCS)" and "Sequence of Operation for HVAC Controls" for solenoid valve controllers, control wiring, and sequence of operation.

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 8 Section "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.

M. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

N. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Install traps and double risers to entrain oil in vertical runs.
4. Liquid lines may be installed level.

O. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

P. Install pipe sleeves at penetrations in exterior walls and floor assemblies.

Q. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

R. Install sleeves through floors, walls, or ceilings, sized to permit installation of full-thickness insulation.

S. Seal pipe penetrations through exterior walls according to Division 7 Section "Joint Sealants" for materials and methods.

T. Identify refrigerant piping and valves according to Division 23 Section "Identification for HVAC Piping and Equipment."

3.3 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.

3.4 HANGERS AND SUPPORTS

A. Hanger, support, and anchor products are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
2. 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.

C. 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.

3.5 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.

3.6 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.

3.7 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.

D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:
    1. Open shutoff valves in condenser water circuit.
    2. Verify that compressor oil level is correct.
    3. Open compressor suction and discharge valves.
    4. Open refrigerant valves except bypass valves that are used for other purposes.
    5. Check open compressor-motor alignment and verify lubrication for motors and bearings.

E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION

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SECTION 233113
METAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rectangular ducts and fittings.
2. Sheet metal materials.
3. Sealants and gaskets.
4. Hangers and supports.

B. Related Sections:

1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.2 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 ASCE/SEI 7.

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ANSI/ASHRAE 62.1.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings:

1. Duct layout indicating sizes, configuration, and static-pressure classes.
2. Elevation of top of ducts.
3. Dimensions of main duct runs from building grid lines.
4. Penetrations through fire-rated and other partitions.
5. Equipment installation based on equipment being used on Project.
6. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
7. Hangers and supports, including methods for duct and building attachment, seismic restraints, and vibration isolation.

1.4 INFORMATIONAL SUBMITTALS

A. 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. Luminaires.
    b. Air outlets and inlets.
    c. Speakers.
    d. Access panels.
    e. Perimeter moldings.

1.5 QUALITY ASSURANCE

A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."

B. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse 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 2-2, "Rectangular Duct/Longitudinal Seams," 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 4, "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 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. 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.

E. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. 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: 3 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, sealant shall have 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. 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.

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

F. 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 for10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.

3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.4 HANGERS AND SUPPORTS

A. Hanger Rods for 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 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "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 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 Section 233300 "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 "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "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 DUCT SEALING

A. Seal ducts at a minimum to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Outdoor, Supply-Air Ducts: Seal Class A.
3. Outdoor, Exhaust Ducts: Seal Class C.
4. Outdoor, Return-Air Ducts: Seal Class C.
5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
7. Unconditioned Space, Exhaust Ducts: Seal Class C.
8. Unconditioned Space, Return-Air Ducts: Seal Class B.
9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
11. Conditioned Space, Exhaust Ducts: Seal Class B.
12. Conditioned Space, Return-Air Ducts: Seal Class C.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "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 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "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.

3.5 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 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 Section 233300 "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. 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.

3.7 START UP

A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.8 DUCT SCHEDULE

A. Supply Ducts:
1. Ducts Connected to Constant-Volume Air-Handling Units:
a. Pressure Class: Positive 2-inch wg.
b. SMACNA Leakage Class for Rectangular: 6.
c. SMACNA Leakage Class for Round: 6.
2. Ducts Connected to Variable-Air-Volume Air-Handling Units Insert equipment:
a. Pressure Class: Positive 3-inch wg.
b. SMACNA Leakage Class for Rectangular: 3.
c. SMACNA Leakage Class for Round: 3.

B. Return Ducts:
1. Ducts Connected to Air-Handling Units:
a. Pressure Class: Positive or negative 2-inch wg.
b. SMACNA Leakage Class for Rectangular: 6.
c. SMACNA Leakage Class for Round and Flat Oval: 6.

C. Exhaust Ducts:
1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
a. Pressure Class: Negative 1-inch wg.
b. SMACNA Leakage Class for Rectangular: 12.
c. SMACNA Leakage Class for Round and Flat Oval: 6.

D. Intermediate Reinforcement:
1. Galvanized-Steel Ducts: Galvanized steel.

E. Elbow Configuration:
1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "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 4-3, "Vanes and Vane Runners," and Figure 4-4, "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 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

F. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."

a. Rectangular Main to Rectangular Branch: 45-degree entry.

b. Rectangular Main to Round Branch: Spin in.

END OF SECTION

SECTION 233300
AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Manual volume dampers.
2. Fire dampers.
3. Flange connectors.
4. Turning vanes.
5. Duct-mounted access doors.
6. Flexible connectors.
7. Duct accessory hardware.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

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 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.

2.2 MATERIALS

A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G60.
2. Exposed-Surface Finish: Mill phosphatized.

B. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish for concealed ducts and finish for exposed ducts.

C. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

D. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.

E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Flexmaster U.S.A., Inc.
   b. McGill AirFlow LLC.

c. Nailor Industries Inc.

d. Ruskin Company.

2. Standard leakage rating.

3. Suitable for horizontal or vertical applications.

4. Frames:

a. Frame: Hat-shaped, 0.094-inch-thick, galvanized sheet steel.

b. Mitered and welded corners.

c. Flanges for attaching to walls and flangeless frames for installing in ducts.

5. Blades:

a. Multiple or single blade.

b. Parallel- or opposed-blade design.

c. Stiffen damper blades for stability.

d. Galvanized-steel, 0.064 inch thick.

6. Blade Axles: Galvanized steel.

7. Bearings:

a. Oil-impregnated bronze.

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.

8. Tie Bars and Brackets: Galvanized steel.

B. Jackshaft:

1. Size: 0.5-inch diameter.

2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.

3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

C. Damper Hardware:

1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch-thick zinc-plated steel, and a 3/4-inch hexagon locking nut.

2. Include center hole to suit damper operating-rod size.

3. Include elevated platform for insulated duct mounting.

2.4 FIRE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck Fan Corporation.

2. Nailor Industries Inc.

3. Ruskin Company.

4. Ward Industries; a brand of Hart & Cooley, Inc.

B. Type: 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 hours.

E. Frame: Curtain type with blades inside airstream; fabricated with roll-formed, 0.034-inch-thick galvanized steel; with mitered and interlocking corners.

F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.

1. Minimum Thickness: 0.05 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, 0.024-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.

2.5 FLANGE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. CL WARD & Family Inc.

2. Ductmate Industries, Inc.

3. Ward Industries; a brand of Hart & Cooley, Inc.

B. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

C. Material: Galvanized steel.

D. Gage and Shape: Match connecting ductwork.

2.6 TURNING VANES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Aero-Dyne Sound Control Co.

2. Ductmate Industries, Inc.

3. Duro Dyne Inc.

4. METALAIRE, Inc.

B. 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.

C. 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.

D. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."

E. Vane Construction: Double wall.

2.7 DUCT-MOUNTED ACCESS DOORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. CL WARD & Family Inc.

2. Ductmate Industries, Inc.

3. Greenheck Fan Corporation.

4. Nailor Industries Inc.

B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."

1. Door:

a. Double wall, rectangular.

b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.

c. Vision panel.

d. Hinges and Latches: 1-by-1-inchbutt or piano hinge and cam latches.

e. 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.

2.8 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. CL WARD & Family Inc.

2. Ductmate Industries, Inc.

3. Duro Dyne Inc.

4. Ventfabrics, Inc.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch-wide, 0.028-inch-thick, galvanized sheet steel or 0.032-inch-thick aluminum sheets. Provide metal compatible with connected ducts.

E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd..

2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.

3. Service Temperature: Minus 40 to plus 200 deg F.

2.9 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install 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.

D. Set dampers to fully open position before testing, adjusting, and balancing.

E. Install test holes at fan inlets and outlets and elsewhere as indicated.

F. Install fire dampers according to UL listing.

G. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

   1. At outdoor-air intakes and mixed-air plenums.
   2. At drain pans and seals.
   3. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
   4. Adjacent to and close enough to fire dampers, to reset or reinstall fusible links. Access doors for access to fire 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.
   5. At each change in direction and at maximum 50-foot spacing.
   6. Upstream from turning vanes.
   7. Control devices requiring inspection.
   8. Elsewhere as indicated.

H. Install access doors with swing against duct static pressure.

I. 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.

J. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

K. Install flexible connectors to connect ducts to equipment.

L. Connect terminal units to supply ducts with maximum lengths of flexible duct. Do not use flexible ducts to change directions.

M. Connect diffusers to ducts directly or with maximum 60-inch lengths of flexible duct clamped or strapped in place.

N. Connect flexible ducts to metal ducts with liquid adhesive plus tape.

O. Install duct test holes where required for testing and balancing purposes.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire 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.

END OF SECTION

SECTION 233346
FLEXIBLE DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Non-insulated flexible ducts.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For flexible ducts.

1. Include plans showing locations and mounting and attachment details.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, and coordinated with each other, using input from installers of the items involved.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

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 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.

C. Comply with the Air Diffusion Council's "ADC Flexible Air Duct Test Code FD 72-R1."

D. Comply with ASTM E 96/E 96M, "Test Methods for Water Vapor Transmission of Materials."

2.2 NON-INSULATED FLEXIBLE DUCTS

A. Products: Subject to compliance with requirements, provide one of the following:

1. Flexmaster U.S.A., Inc;.
2. McGill AirFlow LLC;.
3. Thermaflex; a Flex-Tek Group company;.

B. Non-Insulated, Flexible Duct: UL 181, Class 1, two-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.

2.3 FLEXIBLE DUCT CONNECTORS

A. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches, to suit duct size.

B. Non-Clamp Connectors: Liquid adhesive plus tape.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install flexible ducts 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 in indoor applications only. Flexible ductwork should not be exposed to UV lighting.

C. Connect diffusers or light troffer boots to ducts directly or with maximum 60-inch lengths of flexible duct clamped or strapped in place.

D. Connect flexible ducts to metal ducts with liquid adhesive plus tape.

E. Install duct test holes where required for testing and balancing purposes.

F. Installation:

1. Install ducts fully extended.
2. Do not bend ducts across sharp corners.
3. Bends of flexible ducting shall not exceed a minimum of one duct diameter.
4. Avoid contact with metal fixtures, water lines, pipes, or conduits.
5. Install flexible ducts in a direct line, without sags, twists, or turns.

G. Supporting Flexible Ducts:

1. Suspend flexible ducts with bands 1-1/2 inches wide or wider and spaced a maximum of 48 inches apart. Maximum centerline sag between supports shall not exceed 1/2 inch per 12 inches.
2. Install extra supports at bends placed approximately one duct diameter from center line of the bend.
3. Ducts may rest on ceiling joists or truss supports. Spacing between supports shall not exceed the maximum spacing per manufacturer's written installation instructions.
4. Vertically installed ducts shall be stabilized by support straps at a maximum of 72 inches o.c.

END OF SECTION

SECTION 233416
CENTRIFUGAL HVAC FANS

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. Square in-line centrifugal fans.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes for fans.
2. Rated capacities, operating characteristics, and furnished specialties and accessories.
3. Certified fan performance curves with system operating conditions indicated.
4. Certified fan sound-power ratings.
5. Motor ratings and electrical characteristics, plus motor and electrical accessories.
6. Material thickness and finishes, including color charts.
7. Dampers, including housings, linkages, and operators.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For centrifugal fans to include in normal operation, emergency operation, and maintenance manuals with replacement parts listing.

PART 2 - PRODUCTS

2.1 SQUARE IN-LINE CENTRIFUGAL FANS

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. Greenheck Fan Corporation.
2. Loren Cook Company.

B. Description: Square in-line centrifugal fans.

C. Housing:

1. Housing Material: Reinforced galvanized steel.
2. Housing Coating: None.
3. Housing Construction: Side panels shall be easily removable for service. Include inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.

D. Direct-Drive Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing.

E. Fan Wheels: Aluminum airfoil blades welded to aluminum hub.

F. Motor Enclosure: Totally enclosed, fan cooled.

G. Accessories:

1. Access for Inspection, Cleaning, and Maintenance: Comply with requirements in ASHRAE 62.1.
2. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.

3. Volume-Control Damper: Manually operated with quadrant lock, located in fan outlet.
4. Companion Flanges: For inlet and outlet duct connections.
5. 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.
6. Motor and Drive Cover (Belt Guard): Epoxy-coated steel.
7. Side Discharge: Flange connector and attachment hardware to provide right-angle discharge on side of unit.

2.2 SOURCE QUALITY CONTROL

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

B. AMCA Compliance: Fans shall comply with AMCA 11 and bear the AMCA-Certified Ratings Seal.

C. Fan Sound Ratings: Comply with AMCA 311 and label fans with the AMCA-Certified Ratings Seal. Sound ratings shall comply with AMCA 301. The fans shall be tested according to AMCA 300.

D. Fan Performance Ratings: Comply with AMCA 211 and label fans with AMCA-Certified Rating Seal. The fans shall be tested for air performance - flow rate, fan pressure, power, fan efficiency, air density, speed of rotation, and fan efficiency - according to AMCA 210/ASHRAE 51.

E. Operating Limits: Classify fans according to AMCA 99.

PART 3 - EXECUTION

3.1 INSTALLATION OF CENTRIFUGAL HVAC FANS

A. Install centrifugal fans level and plumb.

B. Disassemble and reassemble units, as required for moving to the final location, according to manufacturer's written instructions.

C. Lift and support units with manufacturer's designated lifting or supporting points.

D. Equipment Mounting:

1. Support duct-mounted centrifugal fans directly from the building structure, using suitable hanging systems as specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

E. Install units with clearances for service and maintenance.

F. Label fans according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

3.2 DUCTWORK CONNECTIONS

A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."

B. Install ducts adjacent to fans to allow service and maintenance.

3.3 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

D. Tests and Inspections:

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 there is adequate maintenance and access space.
4. Verify that cleaning and adjusting are complete.
5. 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.
6. Adjust belt tension.
7. Adjust damper linkages for proper damper operation.
8. Verify lubrication for bearings and other moving parts.
9. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
10. See Section 230593 "Testing, Adjusting, and Balancing For HVAC" for testing, adjusting, and balancing procedures.
11. Remove and replace malfunctioning units and retest as specified above.

E. Test and adjust controls and safeties. Controls and equipment will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain centrifugal fans.

END OF SECTION

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SECTION 233423
HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Centrifugal roof ventilators.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.

PART 2 - PRODUCTS

2.1 CENTRIFUGAL ROOF VENTILATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck Fan Corporation.
2. Aerovent; a division of Twin City Fan Companies, Ltd.
3. Carnes Company.

B. Description:

1. Downblast fan shall be for roof mounted applications
2. Performance capabilities up to 4,300 cubic feet per minute (cfm) and static pressure to 1 inches of water gauge
3. Fans are available in sixteen sizes with nominal wheel diameters ranging from 8 inches through 18 inches (071 - 180 unit sizes)
4. Maximum continuous operating temperature is 180 Fahrenheit
5. Each fan shall bear a permanently affixed manufacturer's engraved metal nameplate containing the model number and individual serial number.

C. Wheel:

1. Constructed of aluminum
2. Non-overloading, backward inclined centrifugal
3. Statically and dynamically balanced in accordance to AMCA Standard 204-05
4. The wheel cone and fan inlet will be matched and shall have precise running tolerances for maximum performance and operating efficiency.

D. Motors:

1. Electronically Commutated Motor

   a. Motor enclosure: ODP

   b. Motor to be a DC electronic commutation type motor (ECM) specifically designed for fan applications. AC induction type motors are not acceptable. Examples of unacceptable motors are: Shaded Pole, Permanent Split Capacitor (PSC), Split Phase, Capacitor Start and 3 phase induction type motors

   c. Motors are permanently lubricated, heavy duty ball bearing type to match with the fan load and pre-wired to the specific voltage and phase

   d. Internal motor circuitry to convert AC power supplied to the fan to DC power to operate the motor

   e. Motor shall be speed controllable down to 20% of full speed (80% turndown). Speed shall be controlled by either a potentiometer dial mounted at the motor or by a 0-10 VDC signal

   f. Motor shall be a minimum of 85% efficient at all speeds

E. Housing:

1. Motor cover, shroud, curb cap, and lower windband shall be constructed of heavy gauge aluminum

2. Shroud shall have an integral rolled bead for extra strength

3. Shroud shall be drawn from a disc and direct air downward

4. Lower windband shall have a formed edge for added strength

5. Motor cover shall be drawn from a disc

6. All housing components shall have final thicknesses equal to or greater then preformed thickness

7. Curb cap shall have pre-punched mounting holes to ensure correct attachment

8. Rigid internal support structure

9. Leak proof

F. Housing Supports and Drive Frame:

1. Drive frame assemblies shall be constructed of heavy gauge steel and mounted on vibration isolators

G. Vibration Isolation:

1. Rubber isolators

2. Sized to match the weight of each fan

H. Disconnect Switches:

1. NEMA rated: NEMA 1: indoor application no water. Factory standard.

2. Positive electrical shut-off

3. Wired from fan motor to junction box installed within motor compartment

I. Options/Accessories:

1. Roof Curb adaptors:

   a. Welded, straight sided curb with 2 inches of flashing flange and wood nailer

   b. Mounted onto roof with fan

   c. Material: Galvanized

   d. Insulation thickness: 1 inches

   e. Coating Type: Permatector

2. Dampers:
    a. Type: WD-100, Gravity
    b. Prevents outside air from entering back into the building when fan is off
    c. Balanced for minimal resistance to flow
    d. Galvanized frames with prepunched mounting holes
3. Finishes:
    a. Permatector - thermo-setting polyester urethane

2.2 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "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.

2.3 SOURCE QUALITY CONTROL

A. Certify sound-power level ratings according to 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. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Equipment Mounting:
    1. Comply with requirements for vibration isolation and seismic control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."

B. Secure roof-mounted fans to roof curbs with cadmium-plated hardware. See Section 077200 "Roof Accessories" for installation of roof curbs.

C. Install units with clearances for service and maintenance.

D. Label units according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

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 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.

C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Comply with requirements in Section 230593 "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

SECTION 233600
AIR TERMINAL UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Shutoff, single-duct air terminal units.
2. Casing liner.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of air terminal unit.

B. Shop Drawings: For air terminal units.

1. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Include diagrams for power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

A. 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:

B. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."

C. ASHRAE Compliance: Applicable requirements in ASHRAE/IES 90.1, "Section 6 - Heating, Ventilating, and Air Conditioning."

2.2 SHUTOFF, SINGLE-DUCT AIR TERMINAL UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Anemostat Products; a Mestek company.
2. ENVIRO-TEC; by Johnson Controls, Inc.
3. METALAIRE, Inc.
4. Trane.

B. Configuration: Volume-damper assembly inside unit casing with control components inside a protective metal shroud.

C. Casing: 0.040-inch- thick galvanized steel, single wall.

1. Casing Liner: Comply with requirements in "Casing Liner" Article for fibrous-glass duct liner.
2. Air Inlet: Round stub connection or S-slip and drive connections for duct attachment.
3. Air Outlet: S-slip and drive connections.

4. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket.
5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

D. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.
1. Maximum Damper Leakage: AHRI 880 rated, 1 percent of nominal airflow at 4-inch wg inlet static pressure.
2. Damper Position: Normally open.

E. Electric-Resistance Heating Coils: Nickel-chromium heating wire, free of expansion noise and hum, mounted in ceramic inserts in a galvanized-steel housing; with primary automatic, and secondary manual, reset thermal cutouts. Terminate elements in stainless-steel, machine-staked terminals secured with stainless-steel hardware.
1. SCR controlled.
2. Access door interlocked disconnect switch.
3. Downstream air temperature sensor with local connection to override discharge-air temperature to not exceed a maximum temperature set point (adjustable).
4. Nickel chrome 80/20 heating elements.
5. Airflow switch for proof of airflow.
6. Fan interlock contacts.
7. Fuses in terminal box for overcurrent protection (for coils more than 48 A).
8. Mercury contactors.
9. Magnetic contactor for each step of control (for three-phase coils).

2.3 CASING LINER

A. Casing Liner: Fibrous-glass duct liner, complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
1. Minimum Thickness: 1 inch.
a. Maximum Thermal Conductivity:
1) Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

2.4 SOURCE QUALITY CONTROL

A. Factory Tests: Test assembled air terminal units according to AHRI 880.
1. Label each air terminal unit with plan number, nominal airflow, maximum and minimum factory-set airflows, coil type, and AHRI certification seal.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 5, "Hangers and Supports" and with Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

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 and for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes and for slabs less than 4 inches thick.

5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hangers Exposed to View: Threaded rod and angle or channel supports.

D. 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.

3.2 TERMINAL UNIT INSTALLATION

A. Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."

B. Install air terminal units level and plumb. Maintain sufficient clearance for normal service and maintenance.

C. Comply with requirements in Section 233113 "Metal Ducts" for connecting ducts to air terminal units.

D. Make connections to air terminal units with flexible connectors complying with requirements in Section 233300 "Air Duct Accessories."

E. Label each air terminal unit with plan number, nominal airflow, and maximum and minimum factory-set airflows. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for equipment labels and warning signs and labels.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. After installing air terminal units and after electrical circuitry has been energized, test for compliance with requirements.

2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Air terminal unit will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.4 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain air terminal units.

END OF SECTION

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SECTION 233713.13
AIR DIFFUSERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rectangular and square ceiling diffusers.

B. Related Requirements:

1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers.
2. Section 233713.23 "Air Registers and Grilles" for adjustable-bar register and grilles, fixed-face registers and grilles, and linear bar grilles.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 RECTANGULAR AND SQUARE CEILING DIFFUSERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Anemostat Products; a Mestek company.
2. Hart & Cooley Inc.
3. METALAIRE, Inc.
4. Price Industries.

B. Ceiling diffusers shall be high performance, high induction, mixing type and shall have a square or rectangular neck. Diffusers shall have a fixed, horizontal air discharge pattern, and shall be configured with a 1,2, 3 or 4 way core / discharge pattern as scheduled. The diffuser core shall be removable, without tools, for cleaning or re-configuring the space air distribution. No screw holes shall be visible. Induction vanes shall be factory welded to the core to prevent tampering or alteration. The induction vanes shall extend to the face of the diffuser and be designed to compress the supply air into jets which will induce room air. Jets from adjacent channels shall alternate in direction from the center outward to promote rapid mixing of room and supply air.

C. Diffusers shall be constructed from steel or aluminum as scheduled. Steel components / hardware required for design integrity are acceptable for aluminum construction.

D. Accessories shall be provided as required and scheduled to meet the design intent. Square to round duct adapters shall be used in transitioning to round duct. Adapters shall be of sufficient height to include opposed blade volume control dampers, and equalizing deflectors as scheduled. Dampers shall be adjustable from the room side by removing, without tools, the inner core assembly.

E. The manufacturer shall provide performance data obtained in accordance with current ANSI/ASHRAE standard 70.

F. The baked-on finish shall be Arctic White, or color as scheduled. If custom, a sample color chip shall be provided to the diffuser manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install diffusers 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 with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.2 ADJUSTING

A. After installation, adjust diffusers to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION

SECTION 233713.23
REGISTERS AND GRILLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fixed face grilles.

B. Related Requirements:

1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to registers and grilles.
2. Section 233713.13 "Air Diffusers" for various types of air diffusers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 GRILLES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Anemostat Products; a Mestek company.
2. Hart & Cooley Inc.
3. METALAIRE, Inc.
4. Price Industries.

B. Perforated Grille:

1. Provide sizes and mounting types as scheduled. For surface mounting applications, countersunk mounting holes shall be provided in the border, with oval head screws also provided by the grille manufacturer. The perforated face pattern shall be 3/16" diameter holes on 1/4" centers with a 51% free area. Grilles shall be constructed from steel, extruded aluminum, or 304 stainless steel as scheduled.
2. Provide a baked-on, arctic white finish, or match color as selected by the architect.

C. Grid Core Grille:

1. The return grilles shall integrate with the ceiling style as scheduled. The core shall be an aluminum grid consisting of a 1/2" x 1/2" x 1/2" cells, and shall have a minimum free area of 90%. For surface mounting applications, the border shall be extruded aluminum, and shall include countersunk screw holes for installation. Lay-in models shall include extension panels where required for the scheduled duct size and grid system module size. The grilles shall have a baked-on arctic white finish.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install grilles level and plumb.

B. Outlets and Inlets Locations: 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 grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.2 ADJUSTING

A. After installation, adjust grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION

SECTION 235523.13

LOW-INTENSITY, GAS-FIRED, RADIANT HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes low-intensity, gas-fired, forced-draft radiant heaters.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For gas-fired, radiant heaters to include in emergency, operation, and maintenance manuals.

1.5 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace components of radiant heaters that fail in materials or workmanship within specified warranty period.

1. Warranty Period: All warranty periods listed below are from date of Substantial Completion.

a. Burner Assembly: Three years.

b. Combustion and Emitter Tubes: Three years.

c. Heater Controls: Three year(s).

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. CSA certified, with CSA Seal and certification number clearly visible on units indicating compliance with ANSI Z83.20/CSA 2.34.

B. UL listed and labeled, with UL label clearly visible on units indicating compliance with ANSI Z83.20/CSA 2.34.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 FORCED-DRAFT HEATERS

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. Roberts-Gordon, Inc.

B. Description: Factory-assembled, indoor, overhead-mounted, electrically controlled, low-intensity, infrared radiant heating units using gas combustion. Heater to have all necessary factory-installed wiring and piping required prior to field installation and startup.

C. Fuel Type: Design burner for natural gas having characteristics same as those of gas available at Project site.

D. Equipment

1. Burner Box

2. Reflectors

3. Radiant Tubing - Heat Exchanger

4. Suspension Materials

5. Heat Demand Control Devices

E. Components

1. Burner Box:

Agency approved burner shall be available in either Natural Gas or Propane models. Enclosed box design with silicone gasketed doors and internally mounted blower, burner cup to be nickel plated finished 16ga. cold rolled steel, factory installed outside air adapter collar for sealed combustion (if outside air is supplied to burner), hot surface ignition module, four-try ignition, door interlock safety switch, all components easily accessed, durable spot welded construction, mica flame observation window, gas and electric controls are separated from the combustion air stream and combustion chamber with spot welded complete barrier, and CSA approved. Burner box paint shall be electrostatically applied epoxy-polyester powder coat for corrosion resistance. Heater shall be equipped with permanently lubricated, internally mounted blower motor with thermal overload protection. Stainless steel flexible gas line and high-pressure gas shutoff assembly included, for U.S. models only. Rubber (Type 1) Gas Hose and high-pressure gas shutoff assembly available for Canadian models.

a. Burner Controls:

1) Factory Wired:

All burners shall be factory wired for 120 Vac operation, Hot Surface Ignition and modulating gas valve, variable speed combustion air blower and control for burner operation sequencing and modulation.

2) Fail-Safe Controls:

To assure a fail-safe operation, the design shall include an air proving safety pressure switch to verify blower operation before gas valve opens. Combustion air pressure shall be continuously monitored and measured by a pressure sensor. A sensed reduction in pressure shall result in corresponding modulated reduction in gas input for maximum safety and combustion quality.

3) Ignition Controls:

All units shall be equipped with a fully automatic Hot Surface Ignition (HSI). The ignition control shall have a pre-purge and timed trial for ignition with 4 ignition trials before lockout occurs. Heater shall have blower post-purge after burner shutdown. Burner shall have a 1 hour automatic reset from lockout.

4) Burner Modulation Controls:

All units shall be equipped with a control to modulate both gas input and combustion air simultaneously to maintain proper combustion and continuously modulate burner input smoothly (not staged or stepped) throughout input range from minimum rated input to maximum rated input. Control shall be configurable for modulating burner input by the following methods: 24V thermostat; zone sensor input; programmable modulating thermostat; remote analog signal (0-10V or 4-20mA) from building management controls; or potentiometer.

2. Reflectors:

   Provide .024' thick commercially pure, hardened aluminum for maximum reflectivity and rigidity, or .025" thick stainless steel reflectors, installed to provide continuous coverage over entire length of heat exchanger. Reflectors shall be a parabolic shape with 11 bends to ensure maximum reflectivity and reflector rigidity. In order to maximize radiant output and minimize convection losses, reflectors are to extend below the bottom of the heat exchanger pipe. Manufacturer shall include end cap fittings are provided as standard equipment with all heaters to minimize convection losses and maintain heat exchanger temperatures.

   a. Cover Elbow Fittings:

      For linear models provide reflector joint pieces over heat exchanger elbows so reflector covers heat exchanger continuously.

   b. End Cap Fittings:

      All reflectors at terminate of the heat exchanger and any elbows shall have end caps to prevent convective heat from escaping.

3. Radiant Tubing – Heat Exchanger:

   a. Burner Tube:

      Shall be ALUMITHERM® steel (aluminized steel/titanium alloy) tube for the first 10 ft. of each radiant heater.

   b. Radiant Tube:

      Shall be 4" OD. Heat Treated Aluminized steel tube 16 gauge wall with an emissivity factor of 0.80 or greater.

   c. Couplings:

      Couplings shall be 12" in length, 28 gauge, 430 Stainless Steel.

4. Suspension Materials:

   The following hanging components to be provided by original manufacturer of heating equipment.

   a. Tube and Reflector Hangers:

      Hangers to be nickel plate finish .312 thick Cold Rolled Steel Rod. Hangers shall provide the option of hanging reflectors at 45°, with 2 connection points. The entire system will be supported by the hangers.

   b. S-Hook:

      For each Tube and Reflector Hanger, manufacturer shall include an S-Hook to attach Tube and Reflector Hanger to chain or other hanging material.

   c. Clamp Package:

      The first Tube and Reflector Hanger to be no more than 4" from the burner and shall include a Clamp Package, provided by manufacturer and installed to prevent burner and tube movement or rotation due to expansion and contraction of system.

   d. Reflector Support Strap & Wire Form:

      Manufacturer shall include as standard a Reflector Support Assembly to hold reflectors in place and prevent against shifting of reflectors as a result of contraction and expansion of system during heating and cooling heating of system and components.

5. Heat Demand Control Devices:

Provide where indicated, low voltage type heat demand control device for each “central” radiant heater.

a. 24V Programmable Modulating Thermostat:

24V electronic modulating thermostat with 7 day time clock and setback features shall be wired to one heater per zone designated as the “central” heater. Communication wiring shall be wired in series from “central” heater to each “satellite” heater in the zone via control wiring. Separate ON/OFF switch optional for “satellite” heaters (not supplied by manufacturer). Thermostat shall control modulation of heater(s) according to the actual space temperature and desired setpoint. Zone averaging and outdoor sensors may be added per the engineer’s specification. LonWorks feature for communication to building management system may be added per the engineer’s specification.

F. Accessories/ Options

1. Outside Air- Separated Combustion

Provide option of fresh outside air to supply each burner for the support of combustion air. Manufacturer shall install an outside air duct connection collar for connection of fresh air supply for all heaters.

2. Venting:

Provide option of venting combustion air through an outside wall or roof.

G. Source Quality Control

1. Performance Verification

Each burner shall be fired and tested and recorded for proper sequence of operation and proper functionality in accordance with manufacturer’s requirements before leaving manufacturing facility.

H. Installation of Gas Fired Radiant Heaters

1. General

All installations and service of low-intensity infrared heating equipment must be performed by a contractor qualified in the installation and service of equipment sold and supplied by Roberts-Gordon and conform to all requirements set forth in the equipment manuals and all applicable governmental authorities pertaining to the installation, service and operation of the equipment. Allow adequate space for servicing or removal of the unit without disturbing other piping or equipment.

2. Support

Suspend heat exchanger, burner, gas piping, conduit, and reflectors from building substrate as indicated, or if not indicated, in manner to provide durable and safe installation; and in accordance with ROBERTS GORDON® installation instructions. Minimum mounting height above floor level to be indicated in equipment manual. All tube must be supported in accordance with acceptable practices, local codes, seismic requirements, and as shown on plans. Heat exchanger tube shall pitch down at least 1/2” in 20’ away from burner box.

3. Clearance To Combustibles

Maintain or exceed clearance to combustibles outlined and printed on burner label, and in ROBERTS GORDON® product data. Measure clearance distance from surface of heat exchanger.

4. Outside Air

   Install outside air piping for sealed combustion as indicated on plan, using only materials indicated in the Installation Operation and Service Manual. 4” diameter outside air supply required for 80,000 or 115,000 BTU/h units, 5” diameter outside air supply required for 150,000 or 200,000 BTU/h units.

5. Venting

   Install vent piping as indicated. Terminate where indicated on the drawings with a vent terminal assembly as supplied by the manufacturer.

6. Gas Piping

   Install gas piping as indicated and in accordance with Z233.1/ NFPA 54 National Fuel Gas Code (latest edition).

   a. Required Gas Supply Inlet Pressures:

Natural Gas Units	Required Min. Gas Pressure	Max. Gas Pressure
80,000-150,000 Btu/h	5.5” wc	14” wc
200,000 Btu/h	6.0” wc	14” wc

   b. Local Codes:

      Gas supply piping must meet local requirements and be sized in accordance with Btu demand, available pressure and total length of supply required for the installation. Connection from supply to burner unit must be made in accordance with installation instructions. Gas shut-off, as supplied with SS Gas Line or Rubber Gas Hose, and controls in unit must not be subjected to more than 1/2 psi. or 14” wc pressure.

7. Electrical Wiring

   Install electrical wiring as indicated. Connect power wiring to burners and control wiring between burners and thermostats in accordance with manufacturer's wiring diagrams.

8. Heat Demand Control Devices

   Provide where indicated, low voltage type heat demand control device connected to “central” radiant heater. Mount heat demand control device 5’– 6’ above finish floor or otherwise as noted on the drawing. Heat demand control device wiring must follow local codes. Install low voltage ON/OFF switch near heat demand control device. If using zone temperature sensors, ON/OFF switch shall be incorporated into sensor design.

9. Thermostat Guards

   Thermostats to be covered with a locking thermostat cover when required.

I. Field Quality Control

1. Start-Up

   Start-up, test, and adjust gas fired radiant heaters in accordance with ROBERTS GORDON® start-up instructions, and Utility Company's requirements. Check controls, adjust burners if applicable according to ROBERTS GORDON® instructions for maximum efficiency.

2. Closeout Procedures

   Provide services of a ROBERTS GORDON® technical representative to instruct operating personnel in operation and maintenance of gas fired radiant heaters.

   a. Building Owner:

      Schedule instruction with operating building owner, provide at least 7 days notice.

3. Annual Maintenance And Cleaning

   To help facilitate optimum performance and safety, Roberts-Gordon recommends that a qualified contractor annually inspect your ROBERTS-GORDON® equipment and perform service where necessary, using only replacement parts sold and supplied by Roberts-Gordon.

4. Codes And Standards

   a. American National Standard / CSA Standard for Gas-Fired Low-Intensity Infrared Heaters:
      Construct and certify gas fired radiant heaters in accordance with latest edition ANSI Z83.20 / CSA 2.34 "Gas-Fired Low-Intensity Infrared Heaters" including all current supplements.

   b. Installation Compliance:
      Install gas fired radiant heaters in accordance with the Installation Operation and Service Manual and the Z223.1/ NFPA 54 National Fuel Gas Code (latest edition).

   c. Compliance:

   d. Provide seal affixed to each burner name plate and provide certification of heater design as vented or unvented infrared heater for indoor installation.

   e. National Standard Gas Piping Compliance:

   f. Install and connect gas piping to gas fired radiant heaters in accordance with Z223.1/ NFPA 54 National Fuel Gas Code (latest edition).

   g. National Electrical Code Compliance:

   h. Install and connect electrical wiring to gas fired radiant heaters in accordance with NFPA 70 "National Electrical Code®" (latest edition).

5. Warranty

   Provide written warranty, by manufacturer, agreeing to replace/repair, within warranty period, components of gas fired radiant systems furnished by manufacturer, which are defective in either material or workmanship, provided manufacturer's instructions for handling, installing, protecting, and maintaining units have been adhered to during warranty periods follows:

   a. Terms:

      1) Three (3) year warranty on the burner system and on the tubing from date of final acceptance of the infrared heaters.

      2) Three (3) years from date of final acceptance of all other components including electrical.

END OF SECTION

SECTION 235533.16

GAS-FIRED UNIT HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes gas-fired unit heaters.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of gas-fired unit heater.

1. Include rated capacities, operating characteristics, and accessories.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For gas-fired unit heaters to include in emergency, operation, and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1.6 QUALITY ASSURANCE

A. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace heat exchanger of gas-fired unit heater that fails in materials or workmanship within specified warranty period.

1. Warranty Period: two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Capacities and Characteristics – see schedule on the drawings.

2.2 MANUFACTURED UNITS

A. Description: Factory assembled, piped, and wired, and complying with ANSI Z83.8/CSA 2.6.

B. Gas Type: Design burner for natural gas having characteristics same as those of gas available at Project site.

C. Type of Venting: Indoor, separated combustion.

D. Housing: Steel, with integral draft hood and inserts for suspension mounting rods.

1. External Casings and Cabinets: Powder coating over corrosion-resistant-treated surface.
2. Discharge Louvers: Independently adjustable, horizontal blades.
3. Discharge Nozzle: Discharge at 25 to 65 degrees from horizontal.

E. Accessories:

1. Four-point suspension kit.
2. Power Venter: Centrifugal aluminized-steel fan, with stainless-steel shaft; 120-V ac motor.

3. Concentric, Terminal Vent Assembly: Combined combustion-air inlet and power-vent outlet with wall or roof caps. Include adapter assembly for connection to inlet and outlet pipes, and flashing for wall or roof penetration.

F. Heat Exchanger: Stainless steel.

G. Burner Material: Stainless steel.

H. Propeller Unit Fan:

1. Aluminum propeller blades riveted to heavy-gage steel spider bolted to cast-iron hub, dynamically balanced, and resiliently mounted.

2. Fan-Blade Guard: Galvanized steel, complying with OSHA specifications, removable for maintenance.

I. Centrifugal Unit Fan:

1. Steel, centrifugal fan dynamically balanced and resiliently mounted.

2. Belt-Driven Drive Assembly:

a. 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.

J. Motors:

1. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

2. Enclosure Materials: Rolled steel.

3. Efficiency: Premium efficient.

K. Controls: Regulated redundant gas valve containing pilot solenoid valve, electric gas valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff all in one body.

1. Gas Control Valve: Two stage.

2. Ignition: Electronically controlled electric spark with flame sensor.

3. Fan Thermal Switch: Operates fan on heat-exchanger temperature.

4. Vent Flow Verification: Differential pressure switch to verify open vent.

5. Control transformer.

6. High Limit: Thermal switch or fuse to stop burner.

7. Thermostat: Devices and wiring are specified in Section 230923.27 "Temperature Instruments."

L. Electrical Connection: Factory wire motors and controls for a single electrical connection.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install and connect gas-fired unit heaters and associated gas and vent features and systems according to NFPA 54, applicable local codes and regulations, and manufacturer's written instructions.

3.2 EQUIPMENT MOUNTING

A. Suspended Units: Suspend from substrate using threaded rods, spring hangers, and building attachments. Secure rods to unit hanger attachments. Adjust hangers so unit is level and plumb.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to gas-fired unit heater, allow space for service and maintenance.

C. Vent Connections: Comply with Section 235123 "Gas Vents."

D. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

E. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform the following tests and inspections:

1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Gas-fired unit heater will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust initial temperature and humidity set points.

B. Adjust burner and other unit components for optimum heating performance and efficiency.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain gas-fired unit heaters.

END OF SECTION

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SECTION 237416.11
PACKAGED, SMALL-CAPACITY, ROOFTOP AIR-CONDITIONING UNITS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Package roof top unit.

B. Heat exchanger.

C. Refrigeration components.

D. Unit operating controls.

E. Roof curb.

F. Electrical power connections.

G. Operation and maintenance service.

1.2 RELATED SECTIONS

A. Section 230513 – Common Motor Requirements for HVAC Equipment.

B. Section 230713 - Duct Insulation.

C. Section 230923 – Direct Digital Control (DDC) System for HVAC.

1.3 REFERENCES

A. NFPA 90 A & B - Installation of Air Conditioning and Ventilation Systems and Installation of Warm Air Heating and Air Conditioning Systems.

B. ANSI/ASHRAE 15 - Safety Code for Mechanical Refrigeration.

C. ANSI/ASHRAE 37 - Testing Unitary Air Conditioning and Heat Pump Equipment.

D. ANSI/ASHRAE/IESNA 90.1-1999 - Energy Standard for New Buildings Except Low-Rise Residential Buildings.

E. ANSI Z21.47/UL1995 - Unitary Air Conditioning Standard for safety requirements.

F. AHRI 210/240 - Unitary Air-Conditioning Equipment and Air- Source Heat Pump Equipment.

G. AHRI 270 - Sound Rating of Outdoor Unitary Equipment.

H. ANSI/NFPA 70-1995 - National Electric Code.

1.4 SUBMITTALS

A. Submit unit performance data including: capacity, nominal and operating performance.

B. Submit Mechanical Specifications for unit and accessories describing construction, components and options.

C. Submit shop drawings indicating overall dimensions as well as installation, operation and services clearances. Indicate lift points and recommendations and center of gravity. Indicate unit shipping, installation and operating weights including dimensions.

D. Submit data on electrical requirements and connection points. Include recommended wire and fuse sizes or MCA, sequence of operation, safety and start-up instructions.

E. Shop drawings submitted for approval shall be accompanied by a copy of the purchase agreement between the Contractor and an authorized service representative of the manufacturer for check, test and start up and first year service.

1.5 DELIVERY, STORAGE and HANDLING

A. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.

B. Protect units from physical damage. Leave factory-shipping covers in place until installation.

1.6 WARRANTY

A. Provide parts warranty (excluding refrigerant) for one year from start-up or 18 months from shipment, whichever occurs first.

B. Provide five-year extended warranty for compressors.

C. Provide five-year heat exchanger limited warranty.

1.7 REGULATORY REQUIREMENTS

A. Unit shall conform to ANSI Z21.47/UL1995 for construction of packaged air conditioner

1. In the event the unit is not UL approved, the manufacturer must, at his expense, provide for a field inspection by a UL representative to verify conformance to UL standards. If necessary, contractor shall perform modifications to the unit to comply with UL, as directed by the UL representative, at no additional expense to the Owner.

1.8 EXTRA MATERIALS

A. Provide 2 set of filters.

PART 2 PRODUCTS

2.1 SUMMARY

A. The contractor shall furnish and install package rooftop unit(s) as shown and scheduled on the contract documents. The unit(s) shall be installed in accordance with this specification and perform at the specified conditions as scheduled.

B. APPROVED MANUFACTURERS

1. Trane
2. Johnson Controls / York
3. Daikin

2.2 GENERAL UNIT DESCRIPTION

A. Unit(s) furnished and installed shall be gas-fired heating/DX cooling packaged rooftop (s) as scheduled on contract documents and these specifications. Cooling capacity ratings shall be based on AHRI Standard. Unit(s) shall consist of insulated weather-tight casing with compressor(s), air-cooled condenser coil, condenser fans, evaporator coil, return-air filters, supply motors and microprocessor unit controls.

B. Unit(s) shall be 100% factory run tested and fully charged with R-410A.

C. Unit(s) shall have labels, decals, and/or tags to aid in the service of the unit and indicate caution areas.

D. Units shall be convertible airflow design as manufactured.

E. Wiring internal to the unit shall be colored and numbered for identification.

2.3 UNIT CASING

A. Cabinet: Galvanized steel, phosphatized, and finished with a pre-applied baked polyurethane enamel. Structural members shall be 18 gauge with access doors and removable panels of a minimum 20 gauge.

B. Unit's cabinet surface shall be tested 672 hours in salt spray test in compliance with ASTM B117.

C. Cabinet construction shall allow for all service/ maintenance from one side of the unit.

D. Cabinet top cover shall be one piece construction or where seams exist, it shall be double-hemmed and gasket-sealed.

E. Access Panels: Water- and air-tight panels with handles shall provide access to filters, heating section, return air fan section, supply air fan section, evaporator coil section, and unit control section.

F. Unit's base pan shall have a raised 1 1/8 inch high lip around the supply and return openings for water integrity.

G. Provide ½ inch foil faced, fire retardant permanent, odorless glass fiber material. All edges must be captured so that there is no insulation exposed in the air stream.

H. The base pan shall have no penetrations within the perimeter of the curb other that the raised 1 1/8 inch high down flow supply/return openings to provide and added water integrity precaution.

I. Provide openings either on side of unit or through the base for power, control, condensate, and gas connections.

J. The base of the unit shall have 3 sides for forklift provisions. The base of the units shall have rigging/lifting holes for crane maneuvering.

2.4 AIR FILTERS

A. Air Filters: Factory installed filters shall mount integral within the unit and shall be accessible through access panels. Two-inch thick glass fiber disposable media filters shall be provided.

B. Filters shall be two inch MERV 8.

2.5 FANS AND MOTORS

A. Provide evaporator fan section with forward curved, double width, double inlet, centrifugal type fan.

B. Provide self-aligning, grease lubricated, ball or sleeve bearings with permanent lubrication fittings.

C. Plenum Fan: All 6-10 ton high efficiency units shall be equipped with a direct drive plenum fan design. Plenum fan design shall include a backward-curved fan wheel along with an external rotor direct drive variable speed indoor motor. All plenum fan designs will have a variable speed adjustment potentiometer located in the control box.

D. Outdoor and Indoor Fan motors shall be permanently lubricated and have internal thermal overload protection.

E. Outdoor fans shall be direct drive, statically and dynamically balanced, draw through in the vertical discharge position.

F. Provide shafts constructed of solid hot rolled steel, ground and polished, with key-way, and protectively coated with lubricating oil.

2.6 GAS FIRED HEATING SECTION

A. Completely assembled and factory installed heating system shall be integral to unit, UL or CSA approved specifically for outdoor applications for use downstream from refrigerant cooling coils. Threaded connection with plug or cap provided. Provide capability for gas piping.

B. Heating section shall be factory run tested prior to shipment.

C. Induced draft combustion type with direct spark ignition system, redundant main gas valve, and modulating gas heat control.

D. Gas Burner Safety Controls: Provide safety controls for the proving of combustion air prior to ignition, and continuous flame supervision. Provide flame rollout switches.

E. Induced draft blower shall have combustion air proving switches and built-in thermal overload protection on fan motor.

F. Units shall be suitable for use with natural gas.

G. Heat Exchanger: Provide tubular section type constructed from 18-gauge aluminized steel.

H. Through the base gas piping- the units shall include a standard through the base gas provision. This option shall have all piping necessary including black steel, manual gas shut off valve, elbows, and union. The manual shutoff valve shall include a 1/8 NPT pressure tap.

I. Burners: Burners shall be of the in-shot type constructed of stainless steel.

J. Limit controls: High temperature limit controls will shut off gas flow in the event of excessive temperatures resulting from restricted indoor airflow or loss of indoor airflow.

2.7 EVAPORATOR COIL SECTION

A. Provide configured aluminum fin surface mechanically bonded to copper tubing coil.

B. Provide an independent expansion device for each refrigeration circuit. Factory pressure tested at 450 psig and leak tested at 200 psig.

C. Provide a removable, reversible, cleanable double sloped drain pan for base of evaporator coil constructed of PVC.

2.8 CONDENSER SECTION

A. Provide vertical discharge, direct drive fans with aluminum blades. Fans shall be statically balanced. Motors shall be permanently lubricated, with integral thermal overload protection in a weather tight casing.

B. Condenser coils shall be of a fully brazed, all-aluminum tube and fin construction. (Microchannel).

C. Provide tool-less factory installed corrosion resistant louvered hail/vandalism guards to protect condenser coils from hail or physical damage.

2.9 REFRIGERATION SYSTEM

A. All units shall have direct drive hermetic, scroll type compressors with centrifugal type oil pumps. Motor shall be suction gas cooled and shall have a voltage utilization range of plus or minus 10 percent of unit nameplate.

B. Provide with thermostatic temperature motor winding control for protection against excessive temperatures caused by over/under voltage operation or loss of charge. Also provide high and low pressure switches.

C. Thermal Expansion valves are standard for all models.

D. Units shall have cooling capabilities down to 0 degree F as standard with microprocessor controls. For field-installed low ambient accessory, the manufacturer shall provide a factory-authorized service technician that will assure proper installation and operation.

E. Provide each unit with 2 refrigerant circuit(s) factory-supplied completely piped with liquid line filter-drier, suction and liquid line pressure ports.

F. Provide Rawal APR Valves or hot gas bypass on each refrigerant circuit to allow modulation at part load from 100% to 25% of rated capacity..

2.10 OUTDOOR AIR SECTION

A. Provide adjustable minimum outside air position control.

B. Provide spring return motor for outside air damper closure during unit shut down or power interruption.

2.11 OPERATING CONTROLS

DDC CONTROLS

A. General: Provide microprocessor controls to allow interconnection with building wide DDC BMX. Resident control algorithms shall make all heating and cooling decisions in response to electronic signals from the BMS as well as zone sensors measuring indoor and outdoor temperatures. The control algorithm shall maintain accurate temperature control, minimizes drift from setpoint and provide better building comfort. A centralized microprocessor shall provide anti-short cycle timing and time delay between compressors to provide a higher level of machine protection.

B. Constant Volume Controls: Provide all necessary controls to operate rooftop from a zone Based temperature sensor, including microprocessor unit control.

C. Clogged filter indication: Provide factory installed differential pressure switch to indicate filter replacement status. Differential pressure switch shall cause a contact closure to display a service indication and unit will continue to operate normally.

D. Provide Discharge Air Temperature Sensing Tube: Provides true discharge air temperature sensing in heating models. This sensor is a status indicator readable through Tracer or Tracker. For Microprocessor controlled units only.

D. Provide factory-installed indoor evaporator defrost control to prevent compressor slugging by interrupting compressor operation.

2.12 STAGING CONTROLS

A. Provide NEC Class II, electronic, adjustable zone control to maintain zone temperature setting.

B. Provide programmable electronic micro-computer-based zone control.

1. Zone control shall incorporate:

a. Automatic changeover from heating to cooling based on signal from BMS.

b. Remote reset of heating and cooling temperatures setpoints.

c. Instant override of setpoint for continuous or timed period from one hour to 31 days.

d. Switch selection features including Fahrenheit display, 12 or 24-hour clock, keyboard disable, remote sensor, fan on-auto.

e. Smart Fan Operation: Allows the unit fan operation to default to the Auto Mode during unoccupied periods, regardless of the Fan switch position.

2. Zone sensor display shall be capable of:

a. Time of day.

b. Actual room temperature.

c. Programmed temperature.

d. Programmed time.

e. Duration of timed override.

f. System mode indication: heating, cooling, low battery, and fan on.

C. Provide remote temperature sensor capability.

2.13 BUILDING MANAGEMENT SYSTEM

A. Lontalk or BACnet Interface control module to Energy Management System to be furnished and mounted by rooftop unit manufacturer. Through this interface module, all Energy Management functions (specified in Energy Management Section) shall be performed. See Building Automation and Automatic Temperature Control System Specifications. The interface module with necessary controls and sensors shall all be factory mounted (not field mounted). If not furnished by rooftop unit manufacturer, this shall be furnished by Energy Management System Contractor for factory mounting by rooftop unit manufacturer in rooftop unit and rated for service up to 140 F. The only field connection to Energy Management System shall be a single communication link.

B. Control Functions: Include unit scheduling, occupied/unoccupied mode, start-up and coast-down modes, nighttime free-cool purge mode, demand limiting, night setback, discharge air set point adjustment, timed override and alarm shutdown.

C. Diagnostic Functions: Include supply fan status, Diagnostic Functions shall Include: Unit operating mode, unit failure status, cooling failure , Heating failure, emergency service stop indication, supply fan proving, timed override activation, high temperature thermostat status, Zone temperature, supply air temperature, cooling status, Stage activation or not, Stage locked out by UCP/HPC status for that stage, compressor disable inputs, Number of stages activated, high temperature limit status, Economizer status, Enthalpy favorability status, Requested minimum position, Damper position, Dry bulb. Enthalpy input status, outside air temperature, outside relative humidity,

D. Sensor failure: Humidity sensor, oat sensor, SAT sensor, RAT sensor, zone temperature sensor, mode input, cooling/heating setpoints from sensors (cv only), static pressure transducer, Unit mounted Potentiometer, SAT from potentiometer , high temp input status, local setpoint, local mode,

E. Provide capabilities for Boolean Processing and trend logs as well as "template" reports and logs.

2.14 ROOF CURB ADAPTOR

A. Contractor shall provide factory supplied roof curb adaptor, 16-gauge perimeter made of zinc coated steel with supply and return air gasketing and wood nailer strips. Ship knocked down and provided with instructions for easy assembly.

B. Curbadaptor shall be manufactured in accordance with the National Roofing Contractors Association guidelines.

PART 3 EXECUTION

3.1 EXAMINATION

A. Contractor shall verify that roof is ready to receive work.

B. Contractor shall verify that proper power supply is available.

3.2 INSTALLATION

A. Contractor shall install in accordance with manufacturer's instructions.

B. Mount units on factory-built roof mounting frame providing watertight enclosure to protect ductwork and utility services. Install roof mounting curb level.

3.3 ELECTRICAL

A. Phase Monitoring Protection: units with 3-phase power are equipped with phase monitoring protection as standard.

B. Through the base electrical with disconnect switch will be installed in the unit in a water tight enclosure with access through a swinging door. Wiring will be provided from the switch to the unit high voltage terminal block. The switch will be cULus agency recognized.

C. Through the base Electrical with circuit Breaker: A thermal magnetic, molded case, HSCR circuit breaker with provisions for through the base electrical connections. The circuit breaker will be installed in a water tight enclosure in the unit with access through a swinging door. Wiring will be provided from the switch to the unit high voltage terminal block. The circuit breaker will provide overcurrent protection, be sized per NEC and cULUS guidelines, and be agency recognized by cULus.

D. Through the Base Electrical Access: An electrical service entrance shall be provided allowing electrical access for both control and power connects inside the curb and through the base of the unit.

E. Powered Convenience outlet: A GFCI 120V/15 amp, 2 plug, convenience outlet. The convenience outlet is powered from the line side of the disconnect or circuit breaker, and will not be affected by the position of the disconnect or circuit breaker. This option can only be ordered when the through the base electrical option is ordered.

E. Wiring internal to the unit shall be colored and numbered for identification.

END OF SECTION

SECTION 237416.13
PACKAGED, LARGE-CAPACITY, ROOFTOP AIR-CONDITIONING UNITS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Package roof top unit.

B. Heat exchanger.

C. Refrigeration components.

D. Unit operating controls.

E. Roof curb.

F. Electrical power connections.

G. Operation and maintenance service.

1.2 RELATED SECTIONS

A. Section 230513 – Common Motor Requirements for HVAC Equipment.

B. Section 230713 - Duct Insulation.

C. Section 230923 – Direct Digital Control (DDC) System for HVAC.

1.3 REFERENCES

A. NFPA 90 A & B - Installation of Air Conditioning and Ventilation Systems and Installation of Warm Air Heating and Air Conditioning Systems.

B. ANSI/ASHRAE 15 - Safety Code for Mechanical Refrigeration.

C. ANSI/ASHRAE 37 - Testing Unitary Air Conditioning and Heat Pump Equipment.

D. ANSI/ASHRAE/IESNA 90.1-1999 - Energy Standard for New Buildings Except Low-Rise Residential Buildings.

E. ANSI Z21.47/UL1995 - Unitary Air Conditioning Standard for safety requirements.

F. AHRI 210/240 - Unitary Air-Conditioning Equipment and Air- Source Heat Pump Equipment.

G. AHRI 270 - Sound Rating of Outdoor Unitary Equipment.

H. ANSI/NFPA 70-1995 - National Electric Code.

1.4 SUBMITTALS

A. Submit unit performance data including: capacity, nominal and operating performance.

B. Submit Mechanical Specifications for unit and accessories describing construction, components and options.

C. Submit shop drawings indicating overall dimensions as well as installation, operation and services clearances. Indicate lift points and recommendations and center of gravity. Indicate unit shipping, installation and operating weights including dimensions.

D. Submit data on electrical requirements and connection points. Include recommended wire and fuse sizes or MCA, sequence of operation, safety and start-up instructions.

E. Shop drawings submitted for approval shall be accompanied by a copy of the purchase agreement between the Contractor and an authorized service representative of the manufacturer for check, test and start up and first year service.

1.5 DELIVERY, STORAGE and HANDLING

A. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.

B. Protect units from physical damage. Leave factory-shipping covers in place until installation.

1.6 WARRANTY

A. Provide parts warranty (excluding refrigerant) for one year from start-up or 18 months from shipment, whichever occurs first.

B. Provide five-year extended warranty for compressors.

C. Provide five-year heat exchanger limited warranty.

1.7 REGULATORY REQUIREMENTS

A. Unit shall conform to ANSI Z21.47/UL1995 for construction of packaged air conditioner

1. In the event the unit is not UL approved, the manufacturer must, at his expense, provide for a field inspection by a UL representative to verify conformance to UL standards. If necessary, contractor shall perform modifications to the unit to comply with UL, as directed by the UL representative, at no additional expense to the Owner.

1.8 EXTRA MATERIALS

A. Provide 2 set of filters.

PART 2 PRODUCTS

2.1 SUMMARY

A. The contractor shall furnish and install package rooftop unit(s) as shown and scheduled on the contract documents. The unit(s) shall be installed in accordance with this specification and perform at the specified conditions as scheduled.

B. APPROVED MANUFACTURERS

1. Trane
2. York/Johnson Controls
3. Daikin

2.2 GENERAL UNIT DESCRIPTION

A. Unit(s) furnished and installed shall be gas-fired heating/DX cooling packaged rooftop (s) as scheduled on contract documents and these specifications. Cooling capacity ratings shall be based on AHRI Standard. Unit(s) shall consist of insulated weather-tight casing with compressor(s), air-cooled condenser coil, condenser fans, evaporator coil, return-air filters, supply motors and microprocessor unit controls.

B. Unit(s) shall be 100% factory run tested and fully charged with R-410A.

C. Unit(s) shall have labels, decals, and/or tags to aid in the service of the unit and indicate caution areas.

D. Units shall be convertible airflow design as manufactured.

E. Wiring internal to the unit shall be colored and numbered for identification.

2.3 UNIT CASING

A. Cabinet: Galvanized steel, phosphatized, and finished with a pre-applied baked polyurethane enamel. Structural members shall be 18 gauge with access doors and removable panels of a minimum 20 gauge.

B. Unit's cabinet surface shall be tested 672 hours in salt spray test in compliance with ASTM B117.

C. Cabinet construction shall allow for all service/ maintenance from one side of the unit.

D. Cabinet top cover shall be one piece construction or where seams exits, it shall be double-hemmed and gasket-sealed.

E. Access Panels: Water- and air-tight panels with handles shall provide access to filters, heating section, return air fan section, supply air fan section, evaporator coil section, and unit control section.

F. Unit's base pan shall have a raised 1 1/8 inch high lip around the supply and return openings for water integrity.

G. Provide ½ inch foil faced, fire retardant permanent, odorless glass fiber material. All edges must be captured so that there is no insulation exposed in the air stream.

H. The base pan shall have no penetrations within the perimeter of the curb other that the raised 1 1/8 inch high down flow supply/return openings to provide and added water integrity precaution.

I. Provide openings either on side of unit or through the base for power, control, condensate, and gas connections.

J. The base of the unit shall have 3 sides for forklift provisions. The base of the units shall have rigging/lifting holes for crane maneuvering.

2.4 AIR FILTERS

A. Air Filters: Factory installed filters shall mount integral within the unit and shall be accessible through access panels. Two-inch thick glass fiber disposable media filters shall be provided.

B. Filters shall be two inch MERV 8.

2.5 FANS AND MOTORS

A. Provide evaporator fan section with forward curved, double width, double inlet, centrifugal type fan.

B. Provide self-aligning, grease lubricated, ball or sleeve bearings with permanent lubrication fittings.

C. Plenum Fan: All 6-10 ton high efficiency units shall be equipped with a direct drive plenum fan design. Plenum fan design shall include a backward-curved fan wheel along with an external rotor direct drive variable speed indoor motor. All plenum fan designs will have a variable speed adjustment potentiometer located in the control box.

D. Outdoor and Indoor Fan motors shall be permanently lubricated and have internal thermal overload protection.

E. Outdoor fans shall be direct drive, statically and dynamically balanced, draw through in the vertical discharge position.

F. Provide shafts constructed of solid hot rolled steel, ground and polished, with key-way, and protectively coated with lubricating oil.

2.6 GAS FIRED HEATING SECTION

A. Completely assembled and factory installed heating system shall be integral to unit, UL or CSA approved specifically for outdoor applications for use downstream from refrigerant cooling coils. Threaded connection with plug or cap provided. Provide capability for gas piping.

B. Heating section shall be factory run tested prior to shipment.

C. Induced draft combustion type with direct spark ignition system, redundant main gas valve, and 2-staged heat.

D. Gas Burner Safety Controls: Provide safety controls for the proving of combustion air prior to ignition, and continuous flame supervision. Provide flame rollout switches.

E. Induced draft blower shall have combustion air proving switches and built-in thermal overload protection on fan motor.

F. Units shall be suitable for use with natural gas.

G. Heat Exchanger: Provide tubular section type constructed from 18-gauge aluminized steel.

H. Through the base gas piping- the units shall include a standard through the base gas provision. This option shall have all piping necessary including black steel, manual gas shut off valve, elbows, and union. The manual shutoff valve shall include a 1/8 NPT pressure tap.

I. Burners: Burners shall be of the in-shot type constructed of stainless steel.

J. Limit controls: High temperature limit controls will shut off gas flow in the event of excessive

temperatures resulting from restricted indoor airflow or loss of indoor airflow.

2.7 EVAPORATOR COIL SECTION

A. Provide configured aluminum fin surface mechanically bonded to copper tubing coil.

B. Provide an independent expansion device for each refrigeration circuit. Factory pressure tested at 450 psig and leak tested at 200 psig.

C. Provide a removable, reversible, cleanable double sloped drain pan for base of evaporator coil constructed of PVC.

2.8 CONDENSER SECTION

A. Provide vertical discharge, direct drive fans with aluminum blades. Fans shall be statically balanced. Motors shall be permanently lubricated, with integral thermal overload protection in a weather tight casing.

B. Condenser coils shall be of a fully brazed, all-aluminum tube and fin construction. (Microchannel).

C. Provide tool-less factory installed corrosion resistant louvered hail/vandalism guards to protect condenser coils from hail or physical damage.

2.9 REFRIGERATION SYSTEM

A. All units shall have direct drive hermetic, scroll type compressors with centrifugal type oil pumps. Motor shall be suction gas cooled and shall have a voltage utilization range of plus or minus 10 percent of unit nameplate.

B. Provide with thermostatic temperature motor winding control for protection against excessive temperatures caused by over/under voltage operation or loss of charge. Also provide high and low pressure switches.

C. Thermal Expansion valves are standard for all models.

D. Units shall have cooling capabilities down to 40 degree F as standard with microprocessor controls. For field-installed low ambient accessory, the manufacturer shall provide a factory-authorized service technician that will assure proper installation and operation.

E. Provide each unit with 2 refrigerant circuit(s) factory-supplied completely piped with liquid line filter-drier, suction and liquid line pressure ports.

F. Provide Rawal APR Valves or hot gas bypass on each refrigerant circuit to allow modulation at part load from 100% to 25% of rated capacity.

2.10 EXHAUST/RETURN SECTION

A. Provide, on down flow units from 3-10 tons, a factory supplied field installed power exhaust assembly that shall assist the barometric relief damper in the economizer in relieving building pressurization.

2.11 OUTDOOR AIR SECTION

A. Provide economizer with dual enthalpy control.

B. Provide adjustable minimum position control located in the economizer section of the unit.

C. Provide spring return motor for outside air damper closure during unit shut down or power interruption.

2.12 OPERATING CONTROLS

DDC CONTROLS

A. General: Provide microprocessor controls to allow interconnection with building wide DDC BMX. Resident control algorithms shall make all heating and cooling decisions in response to electronic signals from the BMS as well as zone sensors measuring indoor and outdoor temperatures. The control algorithm shall maintain accurate temperature control, minimizes drift from setpoint and provide better building comfort. A centralized microprocessor shall provide anti-short cycle timing and time delay between compressors to provide a higher level of machine protection.

B. VAV: Provide all necessary controls to operate a rooftop unit based on maintaining two temperature setpoints: discharge air and zone. During one zone vav cooling, the unit will maintain zone cooling setpoint by modulating the supply fan speed more or less to meet zone load demand; and the unit will maintain discharge temperature to the discharge cooling setpoint by modulating economizer if available and staging dx cooling.

C. Ventilation Override: Provide factory installed, tested and commissioned ventilation override controls. Binary input from independent fire/life safety panel shall cause unit to override standard operation and assume one of two factory preset ventilation sequences: Purge or pressurization.

D. Clogged filter indication: Provide factory installed differential pressure switch to indicate filter replacement status. Differential pressure switch shall cause a contact closure to display a service indication and unit will continue to operate normally.

E. Provide Wall or duct mounted CO2 sensor to monitor space occupancy levels within the building by measuring the parts per million of CO2 (Carbon Dioxide) in the air. As CO2 Levels increase, the economizer fresh air damper shall modulate to meet the co2 space ventilation requirements.

F. Provide Discharge Air Temperature Sensing Tube: Provides true discharge air temperature sensing in heating models. This sensor is a status indicator readable through Tracer or Tracker. For Microprocessor controlled units only.

D. Provide factory-installed indoor evaporator defrost control to prevent compressor slugging by interrupting compressor operation.

E. Economizer Preferred Cooling - Compressor operation is integrated with economizer cycle to allow mechanical cooling when economizer is not adequate to satisfy zone requirements. Compressors are enabled if space temperature is recovering to cooling setpoint at a rate of less than 0.2 degrees per minute. Compressor low ambient lockout overrides this function.

2.13 STAGING CONTROLS

A. Provide NEC Class II, electronic, adjustable zone control to maintain zone temperature setting.

B. Provide programmable electronic microcomputer-based zone control.

1. Zone control shall incorporate:

   a. Automatic changeover from heating to cooling.

   b. Set-up for at least 2 - sets of separate heating and cooling temperatures per day.

   c. Instant override of setpoint for continuous or timed period from one hour to 31 days.

   d. Switch selection features including Fahrenheit display, 12 or 24-hour clock, keyboard disable, remote sensor, fan on-auto.

   e. Smart Fan Operation: Allows the unit fan operation to default to the Auto Mode during unoccupied periods, regardless of the Fan switch position.

   f. Economizer Minimum Position Override: Allows the unit controller to override and close the minimum position setting on the economizer damper during unoccupied time periods.

2. Zone sensor display shall be capable of:
    a. Time of day.
    b. Actual room temperature.
    c. Programmed temperature.
    d. Programmed time.
    e. Duration of timed override.
    f. Day of week.
    g. System mode indication: heating, cooling, low battery, and fan on.

C. Provide remote temperature sensor capability.

D. Provide mixed air sensor in supply air to close outside air damper.

E. Provide Wireless Zone Sensor: LCD display that provides heat, cool, auto or off. Includes two temperature setpoints and a lockable settings.

2.14BUILDING MANAGEMENT SYSTEM

A. Lontalk or BACnet Interface control module to Energy Management System to be furnished and mounted by rooftop unit manufacturer. Through this interface module, all Energy Management functions (specified in Energy Management Section) shall be performed. See Building Automation and Automatic Temperature Control System Specifications. The interface module with necessary controls and sensors shall all be factory mounted (not field mounted). If not furnished by rooftop unit manufacturer, this shall be furnished by Energy Management System Contractor for factory mounting by rooftop unit manufacturer in rooftop unit and rated for service up to 140 F. The only field connection to Energy Management System shall be a single communication link.

B. Control Functions: Include unit scheduling, occupied/unoccupied mode, start-up and coast-down modes, nighttime free-cool purge mode, demand limiting, night setback, discharge air set point adjustment, timed override and alarm shutdown.

C. Diagnostic Functions: Include supply fan status, Diagnostic Functions shall Include: Unit operating mode, unit failure status, cooling failure , Heating failure, emergency service stop indication, supply fan proving, timed override activation, high temperature thermostat status, Zone temperature, supply air temperature, cooling status, Stage activation or not, Stage locked out by UCP/HPC status for that stage, compressor disable inputs, Number of stages activated, high temperature limit status, Economizer status, Enthalpy favorability status, Requested minimum position, Damper position, Dry bulb. Enthalpy input status, outside air temperature, outside relative humidity,

D. Sensor failure: Humidity sensor, oat sensor, SAT sensor, RAT sensor, zone temperature sensor, mode input, cooling/heating setpoints from sensors (cv only), static pressure transducer, Unit mounted Potentiometer, SAT from potentiometer, high temp input status, local setpoint, local mode,

E. Provide capabilities for Boolean Processing and trend logs as well as "template" reports and logs.

2.15 ROOF CURB

A. Contractor shall provide factory supplied roof curb, 16-gauge perimeter made of zinc coated steel with supply and return air gasketing and wood nailer strips. Ship knocked down and provided with instructions for easy assembly.

B. Curb shall be manufactured in accordance with the National Roofing Contractors Association guidelines.

PART 3 EXECUTION

3.1 EXAMINATION

A. Contractor shall verify that roof is ready to receive work.

B. Contractor shall verify that proper power supply is available.

3.2 INSTALLATION

A. Contractor shall install in accordance with manufacturer's instructions.

B. Mount units on factory-built roof mounting frame providing watertight enclosure to protect ductwork and utility services. Install roof mounting curb level.

3.3 ELECTRICAL

A. Phase Monitoring Protection: units with 3-phase power are equipped with phase monitoring protection as standard.

B. Through the base electrical with disconnect switch will be installed in the unit in a water tight enclosure with access through a swinging door. Wiring will be provided from the switch to the unit high voltage terminal block. The switch will be cULus agency recognized.

C. Through the base Electrical with circuit Breaker: A thermal magnetic, molded case, HSCR circuit breaker with provisions for through the base electrical connections. The circuit breaker will be installed in a water tight enclosure in the unit with access through a swinging door. Wiring will be provided from the switch to the unit high voltage terminal block. The circuit breaker will provide overcurrent protection, be sized per NEC and cULUS guidelines, and be agency recognized by cULus.

D. Through the Base Electrical Access: An electrical service entrance shall be provided allowing electrical access for both control and power connects inside the curb and through the base of the unit.

E. Powered Convenience outlet: A GFCI 120V/15 amp, 2 plug, convenience outlet. The convenience outlet is powered from the line side of the disconnect or circuit breaker, and will not be affected by the position of the disconnect or circuit breaker. This option can only be ordered when the through the base electrical option is ordered.

F. Wiring internal to the unit shall be colored and numbered for identification.

END OF SECTION

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SECTION 238126
SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes split-system air-conditioning and heat-pump units consisting of separate evaporator-fan and compressor-condenser components.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.
B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
   1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. The units shall be tested by a Nationally Recognized Testing Laboratory (NRTL) and shall bear the ETL label.
B. All wiring shall be in accordance with the National Electrical Code (N.E.C.) and local codes as required.
C. The units shall be rated in accordance with Air-conditioning, Heating, and Refrigeration Institute's (AHRI) Standard 210 and bear the ARI Certification label.
D. The units shall be manufactured in a facility registered to ISO 9001 and ISO 14001, which is a set of standards applying to environmental protection set by the International Standard Organization (ISO).
E. A dry air holding charge shall be provided in the indoor section.
F. The outdoor unit shall be pre-charged with R-410a refrigerant for 70 feet (20 meters) of refrigerant tubing.- PUY-42NHA4 for 100 feet (30 meters) of refrigerant tubing
G. System efficiency shall meet or exceed SEER values below:

When used with Indoor Unit	Minimum SEER
PKA Wall Mounted Type	14.0

1.6 DELIVERY, STORAGE AND HANDLING

A. Unit shall be stored and handled according to the manufacturer's recommendations.
B. The controller shall be shipped separately and shall be able to withstand 105°F storage temperatures and 95% relative humidity without adverse effect.

1.7 WARRANTY

A. The units shall have a manufacturer's parts and defects warranty for a period five (5) year from date of installation. The compressor shall have a warranty of seven (7) years from date of installation. If, during this period, any part should fail to function properly due to defects in workmanship or material, it shall be replaced or repaired at the discretion of the manufacturer. This warranty does not include labor.
B. Manufacturer shall have over thirty (30) years of continuous experience in the U.S. market.

PART 2 - PRODUCT

2.1 OUTDOOR UNIT DESIGN

A. The outdoor unit shall be compatible with the PKA - wall mounted. The connected indoor unit shall be of the same capacity as the outdoor unit.

B. The outdoor unit shall be equipped with an electronic control board that interfaces with the indoor unit to perform all necessary operation functions.

C. The outdoor unit shall be capable of cooling operation down to 0°F (-18°C) ambient temperature without additional low ambient controls (optional wind baffle shall be required).

D. The outdoor unit shall be able to operate with a maximum height difference of 100 feet (30 meters) between indoor and outdoor units.

E. System shall operate at up to a maximum refrigerant tubing length of 100 feet (30 meters) for the 12,000 and 18,000 BTU/h units between indoor and outdoor units without the need for line size changes, traps or additional oil. Models PUY-A12/18/24/30/36NHA4 shall be pre-charged for a maximum of 70 feet (20 meters) of refrigerant tubing.

F. The outdoor unit shall be completely factory assembled, piped, and wired. Each unit must be test run at the factory.

G. Outdoor unit sound level shall not exceed:

Model Numbers	Cooling
PUY-A12NHA4	46 dB(A)

H. Cabinet

1. The casing shall be constructed from galvanized steel plate, finished with an electrostatically applied, thermally fused acrylic or polyester powder coating for corrosion protection and have a Munsell 3Y 7.8/1.1 finish.
2. Mounting feet shall be provided and shall be welded to the base of the cabinet and be of sufficient size to afford reliable equipment mount and stability.
3. Easy access shall be afforded to all serviceable parts by means of removable panel sections.

a. The fan grill shall be of ABS plastic.
b. Cabinet mounting and construction shall be sufficient to withstand 155 MPH wind speed conditions for use in Hurricane condition areas. Mounting, base support, and other installation to meet Hurricane Code Conditions shall be by others.

I. Fan

1. Models PUY-A18/24/30/36NHA4 shall be furnished with a single DC fan motor.
2. The fan blade(s) shall be of aerodynamic design for quiet operation, and the fan motor bearings shall be permanently lubricated.
3. The outdoor unit shall have horizontal discharge airflow. The fan shall be mounted in front of the coil, pulling air across it from the rear and dispelling it through the front. The fan shall be provided with a raised guard to prevent external contact with moving parts

J. Coil

1. The L shaped condenser coil shall be of copper tubing with flat aluminum fins to reduce debris build up and allow maximum airflow. The coil shall be protected with an integral metal guard.
2. Refrigerant flow from the condenser shall be controlled by means of an electronic linear expansion valve (LEV) metering device. The LEV shall be controlled by a microprocessor-controlled step motor.
3. All refrigerant lines between outdoor and indoor units shall be of annealed, refrigeration grade copper tubing, ACR Type, meeting ASTM B280 requirements, individually insulated in twin-tube, flexible, closed-cell, CFC-free (ozone depletion potential of zero), elastomeric material for the insulation of refrigerant pipes and tubes with thermal conductivity equal to or better than 0.27 BTU-inch/hour per Sq Ft / °F, a water vapor transmission equal to or better than 0.08 Perm-inch and superior fire ratings such that insulation will not contribute significantly to fire and up to 1” thick insulation shall have a - Flame-Spread Index of less than 25 and a Smoke-development Index of less than 50 as tested by ASTM E 84 and CAN / ULC S-102.

K. Compressor
   1. The compressor for models PUY-A12/18/24/30/36NHA4 shall be a DC twin-rotor rotary compressor with Variable Speed Inverter Drive Technology.
   2. The compressor shall be driven by inverter circuit to control compressor speed. The compressor speed shall dynamically vary to match the room load for significantly increasing the efficiency of the system which shall result in significant energy savings.
   3. To prevent liquid from accumulating in the compressor during the off cycle, a minimal amount of current shall be automatically, intermittently applied to the compressor motor windings to maintain sufficient heat to vaporize any refrigerant. No crankcase heater is to be used.
   4. The outdoor unit shall have an accumulator and high-pressure safety switch. The compressor shall be mounted to avoid the transmission of vibration.

L. Electrical
   1. The electrical power of the unit shall be 208volts or 230 volts, single phase, 60 hertz. The unit shall be capable of satisfactory operation within voltage limits of 187 volts to 253 volts.
   2. Power for the indoor unit shall be supplied from the outdoor unit via Mitsubishi Electric A-Control using three (3) fourteen (14) gauge AWG conductors plus ground wire connecting the units.
   3. The outdoor unit shall be controlled by the microprocessor located in the indoor unit.
   4. The control signal between the indoor unit and the outdoor unit shall be pulse signal 24 volts DC.
   a. The unit shall have Pulse Amplitude Modulation circuit to utilize 98% of input power supply.

M. Operating Range:

Operating Range		Indoor Air Intake Temperature	Outdoor Air Intake Temperature
Cooling	Maximum	D.B. 95°F (35°C) W.B. 71°F (21.7°C)	D.B. 115°F (46°C)
	Minimum	D.B. 67°F (19.4°C) W.B. 57°F (13.9°C)	D.B. 0°F (-18°C)*

* Requires wind baffle – without wind baffle: D.B. 23°F (-5°C)

   1. Unit shall be able to provide 100% capacity when operating at 0ºF outdoor air temperature and a wind baffle is used.

2.2 INDOOR UNIT SELECTION AND SPECIFICATION

A. PKA Wall Mounted Type

The indoor unit shall be factory assembled, wired and tested. Contained within the unit shall be all factory wiring and internal piping, control circuit board and fan motor. The unit, in conjunction with the wired wall-mounted controller, wireless wall-mounted controller or wireless handheld controller, shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, and a test run switch. Indoor unit and refrigerant pipes shall be purged with dry nitrogen before shipment from the factory.

Wall Mounted Type Indoor Units	
Model Number	Cooling Capacity
PKA-A12HA4	12,000

   1. Unit Cabinet: The cabinet shall be formed from high strength molded plastic with smooth finish, flat front panel design with access for filter. Cabinet color shall be white – Munsell 1.0Y 9.2/0.2. The unit shall be wall mounted by means of a factory supplied, pre-drilled, mounting plate.
   2. Fan: The indoor unit fan shall be high performance, double inlet, forward curve, direct drive sirocco fan with a single -motor. The fans shall be statically and dynamically balanced and run on a motor with permanently lubricated bearings. The indoor fan shall consist of three (3) speeds: Low, Mid, and Hi and Auto. The fan shall have a selectable Auto fan setting that will adjust the fan speed based on the difference between controller set-point and space temperature.

Indoor unit sound level shall not exceed the levels below:

Model Number	Low Speed	Mid Speed	High Speed
PKA-A12HA4	36 dB(A)	40 dB(A)	44 dB(A)

3. Vane: There shall be a motorized horizontal vane to automatically direct air flow in a horizontal and downward direction for uniform air distribution. The horizontal vane shall significantly decrease downward air resistance for lower sound levels, and shall close the outlet port when operation is stopped. There shall also be a set of vertical vanes to provide horizontal swing airflow movement.
4. Filter: Return air shall be filtered by means of an easily removable washable filter.
5. Coil: The evaporator coil shall be of nonferrous construction with pre-coated aluminum strake fins on copper tubing. The multi-angled heat exchanger shall have a modified fin shape that reduces air resistance for a smoother, quieter airflow. All tube joints shall be brazed with PhosCopper or silver alloy. The coils shall be pressure tested at the factory. A condensate pan and drain shall be provided under the coil. An optional drain pan level switch (DPLS1), designed to connect to the control board, shall be provided if required, and installed on the condensate pan to prevent condensate from overflowing. Option: A condensate mini-pump shall be provided.
6. Electrical: The electrical power of the unit shall be 208 volts or 230 volts, 1 phase, 60 hertz. The system shall be capable of satisfactory operation within voltage limits of 187 volts to 253 volts. The power to the indoor unit shall be supplied from the outdoor unit, using the Mitsubishi Electric A-Control system. For A-Control, a three (3) conductor AWG-14 wire with ground shall provide power feed and bi-directional control transmission between the outdoor and indoor units.
7. Performance: Each system shall perform in accordance to the ratings shown in the table below. Cooling performance shall be based on 80°F DB, 67°F WB (26.7°C DB, 19.4°C WB) for the indoor unit and 95°F DB, 75°F WB (35°C DB, 29.3°C WB) for the outdoor unit.

System Model Number	**Cooling Capacity Btu/h**	**TPW Cooling**	**SEER**	**CFM (Hi/Dry)**
PKA-A12HA4	6,000 – 12,000	1,190	15.2	425

TPW = Total Power Watts

8. System Control: The control system shall consist of a minimum of two (2) microprocessors, one on each indoor and outdoor unit, interconnected by a single non-polar two-wire cable. The microprocessor located in the indoor unit shall have the capability of monitoring return air temperature and indoor coil temperature, receiving and processing commands from a wireless or wired controller, providing emergency operation and controlling the outdoor unit. The control signal between the indoor and outdoor unit shall be pulse signal 24 volts DC. Indoor units shall have the ability to control supplemental heat via connector CN152 and a 12 VDC output.

   a. The indoor unit control board shall have auxiliary control contact connectors to provide:

Function / Model	PKA
CN-2L – Lossnay Control	X
CN-24(152) Back-up Heat	X
CN-32 – Remote Switch	X
CN-51 – Central Control	X

CN-105 – IT Terminal	X

X = Included

b. Remote Controllers

All remote controllers need to be ordered separately from the unit.

1) Wired Remote Controller (PAR-21MAA)

The Wired Remote Controller (PAR-21MAA) shall be approximately 5” x 5” in size and white in color with a light-green LCD display. The PAR-21MAA shall support a selection from multiple languages (Spanish, German, Japanese, Chinese, English, Russian, Italian, or French) for display information. There shall be a built-in weekly timer with up to 8 pattern settings per day. The controller shall consist of an On/Off button, Increase/Decrease Set Temperature buttons, a Cool/Auto/Fan/Dry mode selector, a Timer Menu button, a Timer On/Off button, Set Time buttons, a Fan Speed selector, a Ventilation button, a Test Run button, and a Check Mode button. The controller shall have a built-in temperature sensor. Temperature shall be displayed in either Fahrenheit (°F) or Celsius (°C), and Temperature changes shall be by increments of 1°F (0.5°C). The PAR-21MAA shall have the capability of controlling up to a maximum of 16 systems, as a group with the same mode and set-point for all, at a maximum developed control cable distance of 1,500 feet (500 meters).

The control voltage from the wired controller to the indoor unit shall be 12/24 volts, DC. Field wiring shall run directly from the indoor unit to the wall mounted controller with no splices. Up to two wired controllers shall be able to be used to control one unit.

The basic functions are:

Wired Remote Controller (PAR-21MAA)	
Item	**Description**
Number of Units Controllable	16 units as 1 group
ON/OFF	Run and stop operation
Operation Mode	Switches between Cool/Dry/Auto/Fan/Heat.
Temperature Setting (Range and modes depend on connected unit model)	Sets the setpoint temperature in the following range Cool/Dry: 67°F-87°F Heat: 63°F-83°F Auto: 67°F-83°F
Fan Speed Setting (Range and modes depend on connected unit model)	Hi/Mid-2/Mid-1/Low/Auto
Air Flow Direction Setting (Air flow direction settings depend on the unit model)	Air flow direction angles 100%-80%-60%-40%, Swing.
Weekly Scheduler	ON/OFF/Temperature setting can be done up to 8 times one day in the week. The time can be set by the 1-minute interval.

Wired Remote Controller (PAR-21MAA)	
Item	**Description**
Operating Conditions Display	Setpoint and room temperature. Sensing can be done at the remote controller or the indoor unit depending on the indoor unit dipswitch setting Liquid, discharge, indoor and outdoor pipe temperatures LEV opening pulses, sub cooling and discharge super heat Compressor Operating Conditions: Running current, frequency, input voltage, On/Off status and operating time
Error	When an error is currently occurring on an air conditioner unit, the afflicted unit and the error code are displayed
Ventilation Equipment	Up to 16 indoor units can be connected to an interlocked system that has one LOSSNAY unit. LOSSNAY items that can be set are “Hi”, “Low”, and “Stop”. Ventilation mode switching is not available.
Auto Lock Out Function	Setting/releasing of simplified locking for remote control buttons can be performed. • Locking of all buttons • Locking of all buttons except ON/OFF button

2) Wireless, hand held remote controller (PAR-FL32MA)

The wireless had held remote controller (PAR-FL32MA) shall perform input functions necessary to operate the system. There shall be a wireless receiver built in the indoor unit.

The controller shall have a Power On/Off switch, Mode Selector – Cool, Dry, Heat, Auto, and Powerful Modes - Temperature Setting, Timer Control, Fan Speed Select and Horizontal and Vertical Vane control selector. There shall be an i-See® Sensor Area Selector control. The indoor unit shall perform Self-diagnostic Function and Check Mode switching. Temperature changes shall be in 1ºF (0.5ºC) increments with a setting range of 61 to 88ºF (16 to 31ºC).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

C. Install roof-mounted, compressor-condenser components on equipment supports specified in Section 077200 "Roof Accessories." Anchor units to supports with removable, cadmium-plated fasteners.

D. Equipment Mounting:

1. Comply with requirements for vibration isolation and seismic control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."

E. Install and connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

3.2 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

D. Prepare test and inspection reports.

3.3 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION

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SECTION 238239.16
PROPELLER UNIT HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes propeller unit heaters with electric-resistance heating coils.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. PTFE: Polytetrafluoroethylene plastic.

C. TFE: Tetrafluoroethylene plastic.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, furnished specialties, and accessories.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For propeller unit heaters to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Airtherm; a Mestek company.
2. Berko Heating Products.
3. Trane.

2.2 DESCRIPTION

A. Assembly including casing, coil, fan, and motor in horizontal discharge configuration with adjustable discharge louvers.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with UL 2021.

D. Comply with UL 823.

2.3 PERFORMANCE REQUIREMENTS

A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

B. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

2.4 HOUSINGS

A. Finish: Manufacturer's standard baked enamel applied to factory-assembled and -tested propeller unit heaters before shipping.

B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

C. Discharge Louver: Adjustable fin diffuser for horizontal units and conical diffuser for vertical units.

2.5 COILS

A. Electric-Resistance Heating Coil: Nickel-chromium heating wire, free from expansion noise and 60-Hz hum, embedded in magnesium oxide refractory and sealed in steel or corrosion-resistant metallic sheath with fins no closer than 0.16 inch. Element ends shall be enclosed in terminal box. Fin surface temperature shall not exceed 550 deg F at any point during normal operation.

1. Circuit Protection: One-time fuses in terminal box for overcurrent protection and limit controls for high-temperature protection of heaters.
2. Wiring Terminations: Stainless-steel or corrosion-resistant material.

2.6 FAN AND MOTOR

A. Fan: Propeller type with aluminum wheel directly mounted on motor shaft in the fan venturi.

B. Motor: Permanently lubricated.

2.7 CONTROLS

A. Control Devices:

1. Wall-mounted thermostat.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive propeller unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical connections to verify actual locations before unit-heater installation.

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

3.2 INSTALLATION

A. Install propeller unit heaters to comply with NFPA 90A.

B. Install propeller unit heaters level and plumb.

C. Suspend propeller unit heaters from structure with wall mounting bracket.

D. Install wall-mounted thermostats and switch controls in electrical outlet boxes at heights to match lighting controls. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
2. Operate electric heating elements through each stage to verify proper operation and electrical connections.
3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

B. Units will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust initial temperature set points.

B. 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.

3.5 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain propeller unit heaters.

END OF SECTION

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SECTION 260513
MEDIUM-VOLTAGE CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes cables and related cable splices, terminations, and accessories for medium-voltage (2001 to 35,000 V) electrical distribution systems.

1.3 DEFINITIONS

A. Jacket: A continuous nonmetallic outer covering for conductors or cables.

B. NETA ATS: Acceptance Testing Specification.

C. Sheath: A continuous metallic covering for conductors or cables.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of cable. Include splices and terminations for cables and cable accessories.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Installer: Engage a cable splicer, trained and certified by splice material manufacturer, to install, splice, and terminate medium-voltage cable.

1.7 FIELD CONDITIONS

A. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Construction Manager no fewer than ten days in advance of proposed interruption of electric service.
2. Do not proceed with interruption of electric service without Construction Manager's written permission.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with IEEE C2 and NFPA 70.

C. Source Limitations: Obtain cables and accessories from single source from single manufacturer.

2.2 CABLES

A. Match existing.

2.3 CONNECTORS

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. 3M.
2. ABB, Electrification Business.
3. G&W Electric Company.

B. Comply with ANSI C119.4 for connectors between aluminum conductors or for connections between aluminum to copper conductors.

C. Copper-Conductor Connectors: Copper barrel crimped connectors.

2.4 SOLID TERMINATIONS

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. 3M.
2. ABB, Electrification Business.
3. G&W Electric Company.

B. Type recommended by seal manufacturer for type of cable and installation conditions, including orientation.

2.5 SEPARABLE INSULATED CONNECTORS

A. Description: Modular system, complying with IEEE 386, with disconnecting, single-pole, cable terminators and with matching, stationary, plug-in, dead-front terminals designed for cable voltage and for sealing against moisture.

B. 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. ABB, Electrification Business.
2. Eaton.
3. Richards Manufacturing Co.

C. Terminations at Distribution Points: Modular type, consisting of terminators installed on cables and modular, dead-front, terminal junctions for interconnecting cables.

D. Load-Break Cable Terminators: Elbow-type units with 200-A-load make/break and continuous-current rating; coordinated with insulation diameter, conductor size, and material of cable being terminated. Include test point on terminator body that is capacitance coupled.

E. Dead-Break Cable Terminators: Elbow-type unit with 200-A continuous-current rating; designed for de-energized disconnecting and connecting; coordinated with insulation diameter, conductor size, and material of cable being terminated. Include test point on terminator body that is capacitance coupled.

F. Dead-Front Terminal Junctions: Modular bracket-mounted groups of dead-front stationary terminals that mate and match with above cable terminators. Two-, three-, or four-terminal units as indicated, with fully rated, insulated, watertight conductor connection between terminals and complete with grounding lug, manufacturer's standard accessory stands, stainless-steel mounting brackets, and attaching hardware.

1. Protective Cap: Insulating, electrostatic-shielding, water-sealing cap with drain wire.
2. Portable Feed-Through Accessory: Two-terminal, dead-front junction arranged for removable mounting on accessory stand of stationary terminal junction.
3. Grounding Kit: Jumpered elbows, portable feed-through accessory units, protective caps, test rods suitable for concurrently grounding three phases of feeders, and carrying case.
4. Standoff Insulator: Portable, single dead-front terminal for removable mounting on accessory stand of stationary terminal junction. Insulators suitable for fully insulated isolation of energized cable-elbow terminator.

G. Tool Set: Shotgun hot stick with energized terminal indicator, fault-indicator test tool, and carrying case.

2.6 SPLICE KITS

A. Description: For connecting medium voltage cables; type as recommended by cable or splicing kit manufacturer for the application.

B. 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. 3M.
2. ABB, Electrification Business.
3. Eaton.

C. Standard: Comply with IEEE 404.

D. Splicing Products: As recommended, in writing, by splicing kit manufacturer for specific sizes, materials, ratings, and configurations of cable conductors. Include all components required for complete splice, with detailed instructions.

1. Combination tape and cold-shrink-rubber sleeve kit with rejacketing by cast-epoxy-resin encasement or other waterproof, abrasion-resistant material.
2. Heat-shrink splicing kit of uniform, cross-section, polymeric construction with outer heat-shrink jacket.
3. Premolded, cold-shrink-rubber, in-line splicing kit.
4. Premolded, EPDM splicing body kit with cable joint sealed by interference fit of mating parts and cable.
5. Separable multiway splice system with all components for the required splice configuration.

2.7 MEDIUM-VOLTAGE TAPES

A. Description: Electrical grade, insulating tape rated for medium voltage application.

B. 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. 3M.
2. HellermannTyton.
3. Scapa Industrial; Scapa Group plc.

C. Ethylene/propylene rubber-based, 30-mil splicing tape, rated for 130 deg C operation. Minimum 3/4 inch wide.

D. Silicone rubber-based, 12-mil self-fusing tape, rated for 130 deg C operation. Minimum 1-1/2 inches (38 mm) wide.

E. Insulating-putty, 125-mil elastic filler tape. Minimum 1-1/2 inches wide.

2.8 ARC-PROOFING MATERIALS

A. Description: Fire retardant, providing arc flash protection.

B. 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. 3M.

C. Tape for First Course on Metal Objects: 10-mil-thick, corrosion-protective, moisture-resistant, PVC pipe-wrapping tape.

D. Arc-Proofing Tape: Fireproof tape, flexible, conformable, intumescent to 0.3 inch thick, and compatible with cable jacket.

E. Glass-Cloth Tape: Pressure-sensitive adhesive type, 1 inch wide.

2.9 SOURCE QUALITY CONTROL

A. Test and inspect cables according to ICEA S-97-682 or ICEA S-94-649 before shipping.

B. Test strand-filled cables for water-penetration resistance according to ICEA T-31-610, using a test pressure of 5 psig.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install cables according to IEEE 576.

B. Proof conduits prior to conductor installation by passing a wire brush mandrel and then a rubber duct swab through the conduit. Separate the wire brush and the rubber swab by 48 to 72 inches on the pull rope.

1. Wire Brush Mandrel: Consists of a length of brush approximately the size of the conduit inner diameter with stiff steel bristles and an eye on each end for attaching the pull ropes. If an obstruction is felt, pull the brush back and forth repeatedly to break up the obstruction.

2. Rubber Duct Swab: Consists of a series of rubber discs approximately the size of the conduit inner diameter on a length of steel cable with an eye on each end for attaching the pull ropes. Pull the rubber duct swab through the duct to extract loose debris from the duct.

C. Pull Conductors: Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

1. Where necessary, use manufacturer-approved pulling compound or lubricant that does not deteriorate conductor or insulation.

2. Use pulling means, including fish tape, cable, rope, and basket-weave cable grips, that do not damage cables and raceways. Do not use rope hitches for pulling attachment to cable.

3. Use pull-in guides, cable feeders, and draw-in protectors as required to protect cables during installation.

4. Do not pull cables with ends unsealed. Seal cable ends with rubber tape.

D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members and follow surface contours where possible.

E. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

F. In manholes, handholes, pull boxes, junction boxes, and cable vaults, train cables around walls by the longest route from entry to exit; support cables at intervals adequate to prevent sag.

G. Install sufficient cable length to remove cable ends under pulling grips. Remove length of conductor damaged during pulling.

H. Install cable splices at pull points and elsewhere as indicated; use standard kits. Use dead-front separable watertight connectors in manholes and other locations subject to water infiltration.

I. Install terminations at ends of conductors, and seal multiconductor cable ends with standard kits.

J. Install separable insulated-connector components as follows:

1. Protective Cap: At each terminal junction, with one on each terminal to which no feeder is indicated to be connected.

2. Portable Feed-Through Accessory: At each terminal junction, with one on each terminal.

3. Standoff Insulator: At each terminal junction, with one on each terminal.

K. Arc Proofing: Unless otherwise indicated, arc proof medium-voltage cable at locations not protected by conduit, or termination materials. In addition to arc-proofing tape manufacturer's written instructions, apply arc proofing as follows:

1. Clean cable sheath.

2. Wrap metallic cable components with 10-mil pipe-wrapping tape.

3. Smooth surface contours with electrical insulation putty.
4. Apply arc-proofing tape in one half-lapped layer with coated side toward cable.
5. Band arc-proofing tape with two layers of 1-inch-wide half-lapped, adhesive, glass-cloth tape at each end of the arc-proof tape.

L. Seal around cables passing through fire-rated elements according Division 07.

M. Ground shields of shielded cable at terminations, splices, and separable insulated connectors. Ground metal bodies of terminators, splices, cable and separable insulated-connector fittings, and hardware.

N. Ground shields of shielded cable at one point only. Maintain shield continuity and connections to metal connection hardware at all connection points.

O. Identify cables according to Section 260553 "Identification for Electrical Systems." Identify phase and circuit number of each conductor at each splice, termination, pull point, and junction box. Arrange identification so that it is unnecessary to move the cable or conductor to read the identification.

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS. Certify compliance with test parameters.
2. After installing medium-voltage cables and before electrical circuitry has been energized, test for compliance with requirements.
3. Perform direct-current High Potential test of each new conductor according to NETA ATS, Ch. 7.3.3. Do not exceed cable manufacturer's recommended maximum test voltage.
4. Perform Partial Discharge test of each new conductor according to NETA ATS, Ch. 7.3.3 and to test equipment manufacturer's recommendations.
5. Perform Dissipation Factor test of each new conductor according to NETA ATS, Ch. 7.3.3 and to test equipment manufacturer's recommendations.

B. Medium-voltage cables will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION

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SECTION 260519

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Copper building wire.
2. Metal-clad cable, Type MC.
3. Fire-alarm wire and cable.
4. Connectors and splices.

B. Related Requirements:

1. Section 260513 "Medium-Voltage Cables" for single-conductor and multiconductor cables, cable splices, and terminations for electrical distribution systems with 601 to 35,000 V.

1.3 DEFINITIONS

A. RoHS: Restriction of Hazardous Substances.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 COPPER BUILDING WIRE

A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

B. 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. Belden Inc.
2. General Cable; Prysmian Group North America.
3. Southwire Company, LLC.

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. RoHS compliant.
3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.

E. Conductor Insulation:

1. Type THHN and Type THWN-2: Comply with UL 83.

2.2 METAL-CLAD CABLE, TYPE MC

A. Description: A factory assembly of one or more current-carrying insulated conductors in an overall metallic sheath.

B. 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. AFC Cable Systems; Atkore International.
2. Belden Inc.
3. Southwire Company, LLC.

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. Comply with UL 1569.
3. RoHS compliant.
4. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Circuits:

1. Single circuit with color-coded conductors.

E. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.

F. Ground Conductor: Insulated.

G. Conductor Insulation:

1. Type TFN/THHN/THWN-2: Comply with UL 83.

H. Armor: Aluminum, interlocked.

2.3 FIRE-ALARM WIRE AND CABLE

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. Allied Wire & Cable Inc.
2. Superior Essex Inc.; subsidiary of LS Corp.
3. West Penn Wire.

B. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.

C. Signaling Line Circuits: Twisted, shielded pair, size as recommended by system manufacturer.

D. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation, and complying with requirements in UL 2196 for a two-hour rating.

1. Low-Voltage Circuits: No. 16 AWG, minimum, in pathway.
2. Line-Voltage Circuits: No. 12 AWG, minimum, in pathway.

2.4 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. 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. 3M Electrical Products.

2. Ideal Industries, Inc.
3. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.

C. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.

D. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.
1. Material: Copper.
2. Type: One or two hole with standard barrels.
3. Termination: Compression or crimp.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders:
1. Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits:
1. Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type THHN/THWN-2, single conductors in raceway.

B. Feeders: Type THHN/THWN-2, single conductors in raceway.

C. Exposed Branch Circuits: Type THHN/THWN-2, single conductors in raceway.

D. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Metal-clad cable, Type MC.

E. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.

3.3 INSTALLATION, GENERAL

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

3.4 INSTALLATION OF FIRE-ALARM WIRE AND CABLE

A. Comply with NECA 1 and NFPA 72.

B. Wiring Method: Install wiring in metal pathway according to Section 260533 "Raceways and Boxes for Electrical Systems."
1. Fire-alarm circuits and equipment control wiring associated with fire-alarm system shall be installed in a dedicated raceway system.
a. Raceways used for fire-alarm circuits, and equipment control wiring associated with fire-alarm system, may not contain any other wire or cable.

C. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with fire-alarm system to terminal blocks. Mark each terminal according to system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

D. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes; cabinets; or equipment enclosures where circuit connections are made.

E. Color-Coding: Color-code fire-alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and another for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire-alarm system junction boxes and covers red.

3.5 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

D. Comply with requirements in Section 284621.11 "Addressable Fire-Alarm Systems for connecting, terminating, and identifying wires and cables.

3.6 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.7 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.8 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 07.

3.9 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.

2. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors.

3. Perform each of the following visual and electrical tests:

a. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.

b. Test bolted connections for high resistance using one of the following:

1) A low-resistance ohmmeter.

2) Calibrated torque wrench.

3) Thermographic survey.

c. Inspect compression-applied connectors for correct cable match and indentation.

d. Inspect for correct identification.

e. Inspect cable jacket and condition.

f. Insulation-resistance test on each conductor for ground and adjacent conductors. Apply a potential of 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable for a one-minute duration.

g. Continuity test on each conductor and cable.

h. Uniform resistance of parallel conductors.

4. Initial Infrared Scanning: After Substantial Completion, but before Final Acceptance, perform an infrared scan of each splice in conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.

a. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

b. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

5. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.

B. Cables will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports to record the following:

1. Procedures used.

2. Results that comply with requirements.

3. Results that do not comply with requirements, and corrective action taken to achieve compliance with requirements.

END OF SECTION

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SECTION 260526

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes grounding and bonding systems and equipment.

B. Section includes grounding and bonding systems and equipment, plus the following special applications:

1. Underground distribution grounding.
2. Ground bonding common with lightning protection system.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans showing dimensioned locations of grounding features specified in "Field Quality Control" Article, including the following:

1. Ground rods.
2. Ground rings.
3. Grounding arrangements and connections for separately derived systems.

B. Qualification Data: For testing agency and testing agency's field supervisor.

C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Division 01, include the following:

a. Plans showing as-built, dimensioned locations of system described in "Field Quality Control" Article, including the following:

1) Ground rods.
2) Ground rings.
3) Grounding arrangements and connections for separately derived systems.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

2.2 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. ERICO; brand of nVent Electrical plc.
2. ILSCO.
3. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.

2.3 CONDUCTORS

A. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B3.
2. Stranded Conductors: ASTM B8.
3. Tinned Conductors: ASTM B33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

2.4 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

C. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar or compression type, copper or copper alloy, with two wire terminals.

D. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.

E. Cable-to-Cable Connectors: Compression type, copper or copper alloy.

F. Conduit Hubs: Mechanical type, terminal with threaded hub.

G. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt or socket set screw.

H. Lay-in Lug Connector: Mechanical type, copper rated for direct burial terminal with set screw.

I. Signal Reference Grid Clamp: Mechanical type, stamped-steel terminal with hex head screw.

J. Straps: Solid copper, cast-bronze clamp or copper lugs. Rated for 600 A.

K. U-Bolt Clamps: Mechanical type, copper or copper alloy, terminal listed for direct burial.

L. Water Pipe Clamps:

1. Mechanical type, two pieces with zinc-plated or stainless-steel bolts.
   a. Material: Die-cast zinc alloy.
   b. Listed for direct burial.
2. U-bolt type with malleable-iron clamp and copper ground connector.

2.5 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad; 3/4 inch by 10 feet.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2/0 AWG minimum.

1. Bury at least 30 inches below grade.

C. Grounding Conductors: Green-colored insulation with continuous yellow stripe.

D. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus horizontally, on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.

E. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors.
3. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING AT THE SERVICE

A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

B. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches from the foundation.

3.4 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

C. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

D. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.5 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

C. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.

2. Use exothermic welds for all below-grade connections.

3. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

D. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.

2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.

3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

E. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.

3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

F. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned jumper to bond across flexible duct connections to achieve continuity.

G. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.

2. Make connections with clean, bare metal at points of contact.

3. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

H. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes shall be at least 12 inches deep, with cover.

1. Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closet to service entrance. Set top of test well flush with finished grade or floor.

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.

2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.

3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at individual ground rods. Make tests at ground rods before any conductors are connected.

a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.

b. Perform tests by fall-of-potential method according to IEEE 81.

4. Prepare dimensioned Drawings locating each ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

C. Grounding system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

E. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.

2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.

3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.

4. Pad-Mounted Equipment: 5 ohms.

F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION

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SECTION 260527
GROUNDING AND BONDING FOR BUILDING STRUCTURE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Grounding and bonding requirements.

B. Conductors for grounding and bonding.

C. Connectors for grounding and bonding.

D. Ground rod electrodes.

E. Ground enhancement material.

1.02 RELATED REQUIREMENTS

A. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.

B. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

B. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings 2017.

C. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. UL 467 - Grounding and Bonding Equipment Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Notify Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install ground rod electrodes until final backfill and compaction is complete.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.

C. Shop Drawings:
   1. Indicate proposed arrangement for signal reference grids. Include locations of items to be bonded and methods of connection.

D. Project Record Documents: Record actual locations of grounding electrode system components and connections.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING FOR BUILDING STRUCTURE

A. (26.0527.00) Building grounding grid system.

B. (26.0527.01) Building grounding grid system minimum 1/0 bare AWG stranded copper ground wiring.

C. (26.0527.02) Building grounding grid system 5/8" diameter copper ground rod at 50' intervals maximum.

D. (26.0527.03) Building grounding grid system exothermic weld connection

E. (26.0527.04) Building grounding grid system approved bonding strap / jumper exothermically welded to building steel as shown.

2.02 GROUNDING AND BONDING REQUIREMENTS

A. Do not use products for applications other than as permitted by NFPA 70 and product listing.

B. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

C. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

D. Grounding Electrode System:
   1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
      a. Provide continuous grounding electrode conductors without splice or joint.
      b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
   2. Ground Ring:
      a. Provide a ground ring encircling the building or structure consisting of bare copper conductor not less than 2 AWG in direct contact with earth, installed at a depth of not less than 30 inches (750 mm).
      b. Where location is not indicated, locate ground ring conductor at least 24 inches (600 mm) outside building perimeter foundation.
      c. Provide ground enhancement material around conductor where indicated.
      d. Provide connection from ground ring conductor to:
         1) Perimeter columns of metal building frame.
         2) Ground rod electrodes located as indicated.
   3. Ground Rod Electrode(s):
      a. Provide single electrode unless otherwise indicated or required.
      b. Space electrodes not less than 50 feet (15.25 m) from each other and any other ground electrode.
      c. Where location is not indicated, locate electrode(s) at least 2 feet outside building perimeter foundation as near as possible to electrical service entrance; where possible, locate in softscape (uncovered) area.
   4. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.

2.03 GROUNDING AND BONDING COMPONENTS

A. General Requirements:
   1. Provide products listed, classified, and labeled as suitable for the purpose intended.
   2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 260526:
   1. Use insulated copper conductors unless otherwise indicated.
      a. Exceptions:
         1) Use bare copper conductors where installed underground in direct contact with earth.
         2) Use bare copper conductors where directly encased in concrete (not in raceway).

C. Connectors for Grounding and Bonding:
   1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
   2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
   3. Unless otherwise indicated, use exothermic welded connections for accessible connections.
   4. Manufacturers - Exothermic Welded Connections:
      a. Burndy LLC: www.burndy.com/#sle.
      b. Cadweld, a brand of Erico International Corporation: www.erico.com/#sle.

c. thermOweld, subsidiary of Continental Industries; division of Burndy LLC: www.thermoweld.com/#sle.

D. Ground Rod Electrodes:
1. Comply with NEMA GR 1.
2. Material: Copper-bonded (copper-clad) steel.
3. Size: 5/8 inch (16 mm) diameter by 10 feet (3.0 m) length, unless otherwise indicated.

E. Ground Enhancement Material:
1. Description: Factory-mixed conductive material designed for permanent and maintenance-free improvement of grounding effectiveness by lowering resistivity.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that work likely to damage grounding and bonding system components has been completed.

B. Verify that field measurements are as indicated.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or provide ground plates.

D. Make grounding and bonding connections using specified connectors.
1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

E. Identify grounding and bonding system components in accordance with all applicable codes.

F. Bond new ground grid to existing ground grid.

3.03 BUILDING GROUNDING SYSTEM

A. All work shall, as a minimum, be performed in strict accordance with Article 250 of the National Electric Code, latest edition.

B. Grounding Grid:
1. Furnish and install an embedded ground loop around the entire building perimeter with connections to perimeter ground rods. Footing reinforcing bars and building structural steel to form a grounding grid. The ground loop shall be a minimum of 1/0 AWG bare, stranded copper wire located 1' - 6" outside of the building foundation and a minimum of 2' - 0" below finished grade. The grounding grid shall be provided with a marking tape for identification in the future that can be detected by GPR.

C. Resistance Requirements:
1. The grounding grid shall establish a resistance of less than or equal to 10 ohms to ground. Resistant level shall be consistent throughout the building grounding system. The Electrical Contractor shall perform any and all necessary modifications to the grounding system as might be necessary to achieve the required 10 ohms

maximum resistance to ground and shall, without exceptions, provide the results of the all earth resistance measurements tests to Owner and agents.

D. Ground Grid Components:
   1. Provide a 10' - 0" (minimum length) by 5/8" copper plated steel ground rod, driven at no greater than 50' - 0" intervals along the ground loop or as otherwise indicated on the Drawings, with the top of the rod at the same depth as the ground loop. At 250' - 0", lengthen the ground rod to reach grade level and provide a heavy duty testing well load rated to meet AASHTO "Standard Specification for Highway Bridges" (Latest Edition)) for H-20 load rating.
      a. Connections between the ground loop and ground rods shall be by exothermic welds without exception. Mechanical connectors are prohibited.
   2. Structural ground conductors shall be installed at every other building perimeter column and shall be 1/0 AWG Bare, stranded copper wire installed in 1 inch galvanized rigid steel conduit with grounding bushings where conductors penetrate the foundation and / or finished slab.
      a. Structural grounding conductors shall be, without exception, by exothermic welds to the web of the steel columns at points located 1' - 6" above the finished floor. Mechanical connectors are prohibited.
      b. After the connections are completed and inspected byt he Engineer, the Contractor shall touch-up paint the structural columns.

E. Testing:
   1. Note: Depending upon the results of the earth resistivity tests described below, the Contractor might need to increase the minimum ground rod lengths to 20' - 0" to achieve the required resistance.
   2. Pre-Installation testing:
      a. Prior to the installation of the grounding grid, the Contractor shall obtain earth resistivity tests on the project site in close horizontal and vertical proximity to the location of the future loop. Earth resistivity testing shall not be performed within five (5) days after a rainfall.
      b. The Earth Resistivity Test shall be performed using the "Wenner 4 - Point" method, and shall be conducted using a Dranetz brand, Model 4160 or Model 4500 Ground Resistance Testing Device. Measurements shall be obtained at 10' - 0" and 20' - 0" probe spacing. Provide, without exception, written test reports to owner before proceeding with the installation of the loop.
   3. Post-Installation Testing:
      a. Upon completion of the ground loop, connections to footing reinforcing bars and ground rods, backfilling and compaction of the site and prior to placement of any pavement sub-base material or landscaping topsoil; the contractor shall perform earth resistivity tests employing the "Fall of Potential Method". Ground resistance testing shall not be performed with five (5) days after a rainfall. Results of the earth resistivity tests shall be provided to owner.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions. Submit report to the Engineer.

C. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

END OF SECTION

SECTION 260529

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Steel slotted support systems.
2. Conduit and cable support devices.
3. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
   a. Slotted support systems, hardware, and accessories.
2. Include rated capacities and furnished specialties and accessories.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame Rating: Class 1.
2. Self-extinguishing according to ASTM D635.

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32-inch-diameter holes at a maximum of 8 inches o.c. in at least one surface.

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. CADDY; brand of nVent Electrical plc.
   b. Cooper B-line; brand of Eaton, Electrical Sector.
   c. Unistrut; Atkore International.
2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
3. Material for Channel, Fittings, and Accessories: Galvanized steel.
4. Channel Width: Selected for applicable load criteria.
5. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.

B. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

C. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

   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) Hilti, Inc.

      2) MKT Fastening, LLC.

      3) Simpson Strong-Tie Co., Inc.

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

   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) Cooper B-line; brand of Eaton, Electrical Sector.

      2) Hilti, Inc.

      3) ITW Ramset/Red Head; Illinois Tool Works, Inc.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.

4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.

5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM F3125/F3125M, Grade A325.

6. Toggle Bolts: Steel springhead type.

7. Hanger Rods: Threaded steel.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with the following standards for application and installation requirements of hangers and supports, except where requirements on Drawings or in this Section are stricter:

1. NECA 1.

2. NECA 101

3. NECA 102.

4. NECA 105.

5. NECA 111.

B. Comply with requirements in Division 07 for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.

C. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."

D. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

E. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with two-bolt conduit clamps.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, according to NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.

2. To New Concrete: Bolt to concrete inserts.

3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.

4. To Existing Concrete: Expansion anchor fasteners.

5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.

6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts; beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69; or spring-tension clamps.

7. To Light Steel: Sheet metal screws.

8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.3 CONCRETE BASES

A. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03.

C. Anchor equipment to concrete base as follows:

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

2. Install anchor bolts to elevations required for proper attachment to supported equipment.

3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

END OF SECTION

SECTION 260533

RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Metal conduits and fittings.
2. Nonmetallic conduits and fittings.
3. Metal wireways and auxiliary gutters.
4. Boxes.

B. Related Requirements:

1. Division 07 for firestopping at conduit and box entrances.
2. Section 260543 "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.

1.3 DEFINITIONS

A. GRC: Galvanized rigid steel conduit.

B. IMC: Intermediate metal conduit.

1.4 ACTION SUBMITTALS

A. Product Data: For wireways and fittings.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Where noted on the Drawings, provide conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:

1. Structural members in paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

A. Metal Conduit:

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. Allied Tube & Conduit; Atkore International.
   b. Anaconda Sealtite; Anamet Electrical, Inc.
   c. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.
2. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. GRC: Comply with ANSI C80.1 and UL 6.
4. IMC: Comply with ANSI C80.6 and UL 1242.

5. EMT: Comply with ANSI C80.3 and UL 797.
6. FMC: Comply with UL 1; zinc-coated stee].
7. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

B. Metal Fittings:
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. Allied Tube & Conduit; Atkore International.
   b. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.
   c. Wheatland Tube; Zekelman Industries.
2. Comply with NEMA FB 1 and UL 514B.
3. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
4. Fittings, General: Listed and labeled for type of conduit, location, and use.
5. Fittings for EMT:
   a. Material: Steel or die cast.
   b. Type: Compression.
6. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.

C. Joint Compound for IMC, or GRC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS AND FITTINGS

A. Nonmetallic Conduit:
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. Anaconda Sealtite; Anamet Electrical, Inc.
   b. Lamson & Sessions.
   c. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
2. Listing and Labeling: Nonmetallic conduit shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. Fiberglass:
   a. Comply with NEMA TC 14.
   b. Comply with UL 2515 for aboveground raceways.
   c. Comply with UL 2420 for belowground raceways.
4. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

B. Nonmetallic Fittings:
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. Anaconda Sealtite; Anamet Electrical, Inc.

b. Lamson & Sessions.

c. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.

2. Fittings, General: Listed and labeled for type of conduit, location, and use.

3. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

4. Solvents and Adhesives: As recommended by conduit manufacturer.

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

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. Cooper B-line; brand of Eaton, Electrical Sector.

2. Hoffman; brand of nVent Electrical plc.

3. Square D; Schneider Electric USA.

B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Screw-cover type unless otherwise indicated.

E. Finish: Manufacturer's standard enamel finish.

2.4 BOXES

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. Crouse-Hinds; brand of Eaton, Electrical Sector.

2. Hubbell Electrical Solutions; Hubbell Incorporated.

3. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.

4. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.

B. General Requirements for Boxes: Boxes installed in wet locations shall be listed for use in wet locations.

C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

E. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

1. and application.

F. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.

G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

H. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, galvanized, cast iron with gasketed cover.

I. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

J. Gangable boxes are prohibited.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC.
2. Concealed Conduit, Aboveground: GRC.
3. Underground Conduit: RNC, **Type EPC-40-PVC**, **direct buried**.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: IMC.
4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: IMC.
7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in damp or wet locations.

C. Minimum Raceway Size: 3/4-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. EMT: Use compression, steel or cast-metal fittings. Comply with NEMA FB 2.10.
3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

3.2 INSTALLATION

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

B. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

C. Do not fasten conduits onto the bottom side of a metal deck roof.

D. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

E. Complete raceway installation before starting conductor installation.

F. Arrange stub-ups so curved portions of bends are not visible above finished slab.

G. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.

H. Make bends in raceway using large-radius preformed ells. Field bending shall be according to NFPA 70 minimum radii requirements. Use only equipment specifically designed for material and size involved.

I. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

J. Support conduit within 12 inches of enclosures to which attached.

K. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot intervals.

2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.

3. Arrange raceways to keep a minimum of 1 inch of concrete cover in all directions.

4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.

5. Change from RNC, Type EPC-40-PVC to GRC before rising above floor.

L. Stub-Ups to Above Recessed Ceilings:

1. Use EMT for raceways.

2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

M. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

N. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

O. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

P. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

Q. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

R. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

S. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

T. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.

U. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where an underground service raceway enters a building or structure.

2. Conduit extending from interior to exterior of building.

3. Where otherwise required by NFPA 70.

V. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

W. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 36 inches of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations.

X. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

Y. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

Z. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

AA. Locate boxes so that cover or plate will not span different building finishes.

BB. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

CC. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

3.3 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install 0sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.4 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Division 07.

END OF SECTION

SECTION 260543

UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Metal conduits and fittings, including GRC and PVC-coated steel conduit.
2. Rigid nonmetallic duct.
3. Flexible nonmetallic duct.
4. Duct accessories.
5. Polymer concrete handholes and boxes with polymer concrete cover.
6. Precast manholes.
7. Utility structure accessories.

1.3 DEFINITIONS

A. Direct Buried: Duct or a duct bank that is buried in the ground, without any additional casing materials such as concrete.

B. Duct: A single duct or multiple ducts. Duct may be either installed singly or as component of a duct bank.

C. Duct Bank:

1. Two or more ducts installed in parallel, with or without additional casing materials.
2. Multiple duct banks.

D. GRC: Galvanized rigid (steel) conduit.

E. Trafficways: Locations where vehicular or pedestrian traffic is a normal course of events.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include duct-bank materials, including spacers and miscellaneous components.
2. Include duct, conduits, and their accessories, including elbows, end bells, bends, fittings, and solvent cement.
3. Include accessories for manholes, handholes, boxes, and other utility structures.
4. Include underground-line warning tape.

B. Shop Drawings:

1. Precast or Factory-Fabricated Underground Utility Structures:

a. Include plans, elevations, sections, details, attachments to other work, and accessories.

b. Include duct entry provisions, including locations and duct sizes.

c. Include reinforcement details.

d. Include frame and cover design and manhole chimneys.

e. Include grounding details.

f. Include dimensioned locations of cable rack inserts, pulling-in and lifting irons, and sumps.

g. Include joint details.

2. Factory-Fabricated Handholes and Boxes Other Than Precast Concrete:

a. Include dimensioned plans, sections, and elevations, and fabrication and installation details.

b. Include duct entry provisions, including locations and duct sizes.

c. Include cover design.

d. Include grounding details.

e. Include dimensioned locations of cable rack inserts, and pulling-in and lifting irons.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: For concrete and steel used in precast concrete manholes, as required by ASTM C858.

1.6 FIELD CONDITIONS

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions, and then only after arranging to provide temporary electrical service according to requirements indicated:

1. Notify Construction Manager no fewer than ten days in advance of proposed interruption of electrical service.

2. Do not proceed with interruption of electrical service without Construction Manager's written permission.

B. Ground Water: Assume ground-water level is at grade level unless a lower water table is noted on Drawings.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND FITTINGS

A. GRC: Comply with ANSI C80.1 and UL 6.

B. 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. Allied Tube & Conduit; Atkore International.

2. Wheatland Tube; Zekelman Industries.

C. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.

2.2 RIGID NONMETALLIC DUCT

A. Underground Plastic Utilities Duct: Type EPC-40-PVC RNC, complying with NEMA TC 2 and UL 651, with matching fittings complying with NEMA TC 3 by same manufacturer as duct.

B. 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. Lamson & Sessions.

C. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.

D. Solvents and Adhesives: As recommended by conduit manufacturer.

2.3 DUCT ACCESSORIES

A. Duct Spacers: Factory-fabricated, rigid, PVC interlocking spacers; sized for type and size of duct with which used, and selected to provide minimum duct spacing indicated while supporting duct during concreting or backfilling.

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. ABB, Electrification Business.

b. Allied Tube & Conduit; Atkore International.

c. Cantex Inc.

B. Underground-Line Warning Tape: Comply with requirements for underground-line warning tape specified in Section 260553 "Identification for Electrical Systems."

2.4 PRECAST CONCRETE HANDHOLES AND BOXES

A. Description: Factory-fabricated, reinforced-concrete, monolithically poured walls and bottom unless open-bottom enclosures are indicated. Frame and cover shall form top of enclosure and shall have load rating consistent with that of handhole or box.

B. 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. Oldcastle Infrastructure Inc.; CRH Americas.

2. Utility Concrete Products, LLC.

3. Utility Vault Co.

C. Comply with ASTM C858 for design and manufacturing processes.

D. Frame and Cover: Weatherproof cast-iron frame, with cast-iron cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.

E. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.

F. Cover Legend: Molded lettering, **"ELECTRIC".**

G. Configuration: Units shall be designed for flush burial and have closed bottom unless otherwise indicated.

H. Extensions and Slabs: Designed to mate with bottom of enclosure. Same material as enclosure.

1. Extension shall provide increased depth as required.

2. Slab: Same dimensions as bottom of enclosure, and arranged to provide closure.

I. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.

J. Knockout Panels: Precast openings in walls, arranged to match dimensions and elevations of approaching duct, plus an additional 12 inches vertically and horizontally to accommodate alignment variations.

1. Knockout panels shall be located no less than 6 inches from interior surfaces of walls, floors, or frames and covers of handholes, but close enough to corners to facilitate racking of cables on walls.

2. Knockout panel opening shall have cast-in-place, welded-wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct.

3. Knockout panels shall be framed with at least two additional No. 3 steel reinforcing bars in concrete around each opening.

4. Knockout panels shall be 1-1/2 to 2 inches thick.

K. Duct Entrances in Handhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.

1. Type and size shall match fittings to duct to be terminated.

2. Fittings shall align with elevations of approaching duct and be located near interior corners of handholes to facilitate racking of cable.

L. Handholes 12 inches wide by 24 inches long and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.5 POLYMER CONCRETE HANDHOLES AND BOXES WITH POLYMER CONCRETE COVER

A. Description: Molded of sand and aggregate, bound together with a polymer resin, and reinforced with steel or fiberglass or a combination of the two.

B. 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. Quazite; brand of Hubbell Utility Solutions; Hubbell Incorporated.

C. Standard: Comply with SCTE 77. Comply with tier requirements in "Underground Enclosure Application" Article.

D. Color: Gray.

E. Configuration: Units shall be designed for flush burial and have closed bottom unless otherwise indicated.

F. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.

G. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.

H. Cover Legend: Molded lettering, "ELECTRIC."

I. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering duct for secure, fixed installation in enclosure wall.

2.6 PRECAST MANHOLES

A. Description: One-piece units and units with interlocking mating sections, complete with accessories, hardware, and features.

B. 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. Oldcastle Infrastructure Inc.; CRH Americas.

2. Utility Concrete Products, LLC.

3. Utility Vault Co.

C. Comply with ASTM C858.

D. Structural Design Loading: Comply with requirements in "Underground Enclosure Application" Article.

E. Knockout Panels: Precast openings in walls, arranged to match dimensions and elevations of approaching duct, plus an additional 12 inches vertically and horizontally to accommodate alignment variations.

1. Knockout panels shall be located no less than 6 inches from interior surfaces of walls, floors, or roofs of manholes, but close enough to corners to facilitate racking of cables on walls.

2. Knockout panel opening shall have cast-in-place, welded-wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct.

3. Knockout panel shall be framed with at least two additional No. 3 steel reinforcing bars in concrete around each opening.

4. Knockout panels shall be 1-1/2 to 2 inches thick.

F. Duct Entrances in Manhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.

1. Type and size shall match fittings to duct to be terminated.

2. Fittings shall align with elevations of approaching duct and be located near interior corners of manholes to facilitate racking of cable.

G. Ground Rod Sleeve: Provide a 3-inch PVC sleeve in manhole floors 2 inches from the wall adjacent to, but not underneath, the duct entering the structure.

H. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.

2.7 UTILITY STRUCTURE ACCESSORIES

A. Accessories for Utility Structures: Utility equipment and accessory items used for utility structure access and utility support, listed and labeled for intended use and application.

B. 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. Utility Concrete Products, LLC.

2. Utility Vault Co.

C. Manhole Frames, and Covers: Comply with structural design loading specified for manhole.

1. Frame and Cover: Weatherproof, gray cast iron complying with ASTM A48/A48M, Class 30B with milled cover-to-frame bearing surfaces; diameter, 26 inches.

a. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.

2. Cover Legend: Cast in. Selected to suit system.

a. Legend: "ELECTRIC-LV" for duct systems with power wires and cables for systems operating at 600 V and less.

b. Legend: "ELECTRIC-HV" for duct systems with medium-voltage cables.

D. Manhole Sump Frame and Grate: ASTM A48/A48M, Class 30B, gray cast iron.

E. Ground Rod Sleeve: 3-inch PVC sleeve in manhole floors 2 inches from the wall adjacent to, but not underneath, the ducts routed from the facility.

F. Duct-Sealing Compound: Nonhardening, safe for contact with human skin, not deleterious to cable insulation, and workable at temperatures as low as 35 deg F. Capable of withstanding temperature of 300 deg F without slump and adhering to clean surfaces of plastic ducts, metallic conduit, conduit and duct coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and common metals.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate layout and installation of duct, duct bank, manholes, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field. Notify Architect if there is a conflict between areas of excavation and existing structures or archaeological sites to remain.

B. Coordinate elevations of duct and duct-bank entrances into manholes, handholes, and boxes with final locations and profiles of duct and duct banks, as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations as required to suit field conditions and to ensure that duct and duct bank will drain to manholes and handholes, and as approved by Architect.

3.2 UNDERGROUND DUCT APPLICATION

A. Duct for Electrical Feeders 600 V and Less: Type EPC-40-PVC RNC, direct-buried unless otherwise indicated.

B. Duct for Electrical Branch Circuits: Type EPC-40-PVC RNC, direct-buried unless otherwise indicated.

C. Stub-ups: Concrete-encased GRC.

3.3 UNDERGROUND ENCLOSURE APPLICATION

A. Handholes and Boxes for 600 V and Less:

1. Units in Roadways and Other Deliberate Traffic Paths: Precast concrete. AASHTO HB 17, H-20 structural load rating.

2. Units in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Polymer concrete, SCTE 77, Tier 15 structural load rating.

3. Units in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Polymer concrete units, SCTE 77, Tier 8 structural load rating.

4. Cover design load shall not exceed the design load of the handhole or box.

B. Manholes: Precast concrete.

1. Units Located in Roadways and Other Deliberate Traffic Paths by Heavy or Medium Vehicles: H-20 structural load rating according to AASHTO HB 17.

2. Units Not Located in Deliberate Traffic Paths by Heavy or Medium Vehicles: H-10 load rating according to AASHTO HB 17.

3.4 EARTHWORK

A. Excavation and Backfill: Comply with Division 03, but do not use heavy-duty, hydraulic-operated, compaction equipment.

B. Restoration: Replace **area immediately after backfilling is completed.**

C. Restore surface features at areas disturbed by excavation, and re-establish original grades unless otherwise indicated. Replace removed sod immediately after backfilling is completed.

D. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Division 03.

E. Cut and patch existing pavement in the path of underground duct, duct bank, and underground structures according to Division 01.

3.5 DUCT AND DUCT-BANK INSTALLATION

A. Install duct, spacers, and accessories into the duct-bank configuration as required. Duct installation requirements in this Section also apply to duct bank.

B. Install duct according to NEMA TCB 2.

C. Slope: Pitch duct a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope duct from a high point between two manholes, to drain in both directions.

D. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48 inches, both horizontally and vertically, at other locations unless otherwise indicated.

1. Duct shall have maximum of two 90 degree bends or the total of all bends shall be no more 180 degrees between pull points.

E. Joints: Use solvent-cemented joints in duct and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent duct do not lie in same plane.

F. Installation Adjacent to High-Temperature Steam Lines: Where duct is installed parallel to underground steam lines, perform calculations showing the duct will not be subject to environmental temperatures above 40 deg C. Where environmental temperatures are calculated to rise above 40 deg C, and anywhere the duct crosses above an underground steam line, install insulation blankets listed for direct burial to isolate the duct bank from the steam line.

G. End Bell Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 10 inches o.c. for 5-inch duct, and vary proportionately for other duct sizes.

1. Begin change from regular spacing to end-bell spacing 10 feet from the end bell, without reducing duct slope and without forming a trap in the line.

2. Expansion and Deflection Fittings: Install an expansion and deflection fitting in each duct in the area of disturbed earth adjacent to manhole or handhole. Install an expansion fitting near the center of all straight line direct-buried duct with calculated expansion of more than 3/4 inch.

3. Grout end bells into structure walls from both sides to provide watertight entrances.

H. Terminator Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use manufactured, cast-in-place duct terminators, with entrances into structure spaced approximately 6 inches o.c. for 4-inch duct, and vary proportionately for other duct sizes.

1. Begin change from regular spacing to terminator spacing 10 feet from the terminator, without reducing duct line slope and without forming a trap in the line.

2. Expansion and Deflection Fittings: Install an expansion and deflection fitting in each duct in the area of disturbed earth adjacent to manhole or handhole. Install an expansion fitting near the center of all straight line duct with calculated expansion of more than 3/4 inch.

I. Building Wall Penetrations: Make a transition from underground duct to GRC at least 10 feet outside the building wall, without reducing duct line slope away from the building and without forming a trap in the line. Use fittings manufactured for RNC-to-GRC transition. Install GRC penetrations of building walls as specified in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

J. Sealing: Provide temporary closure at terminations of duct with pulled cables. Seal spare duct at terminations. Use sealing compound and plugs to withstand at least 15-psig hydrostatic pressure.

K. Pulling Cord: Install 200-lbf-test nylon cord in empty ducts.

L. Direct-Buried Duct and Duct Bank:

1. Excavate trench bottom to provide firm and uniform support for duct. Comply with requirements in Division 03 for preparation of trench bottoms for pipes less than 6 inches in nominal diameter.

2. Width: Excavate trench 12 inches wider than duct on each side.

3. Depth: Install top of duct at least 36 inches below finished grade unless otherwise indicated.

4. Set elevation of bottom of duct bank below frost line.

5. Support ducts on duct spacers coordinated with duct size, duct spacing, and outdoor temperature.

6. Spacer Installation: Place spacers close enough to prevent sagging and deforming of duct, with not less than four spacers per 20 feet of duct. Place spacers within 24 inches of duct ends. Stagger spacers approximately 6 inches between tiers. Secure spacers to earth and to ducts to prevent floating during concreting. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
7. Install duct with a minimum of 3 inches between ducts for like services and 6 inches between power and communications duct.
8. Elbows: Install manufactured duct elbows for stub-ups, at building entrances, and at changes of direction in duct direction unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
9. Install manufactured GRC elbows for stub-ups, at building entrances, and at changes of direction in duct.
    a. Couple RNC duct to GRC with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
    b. Stub-ups to Outdoor Equipment: Extend concrete-encased GRC horizontally a minimum of 60 inches from edge of base. Install insulated grounding bushings on terminations at equipment.
        1) Stub-ups shall be minimum 4 inches above finished floor and minimum 3 inches from conduit side to edge of slab.
    c. Stub-ups to Indoor Equipment: Extend concrete-encased GRC horizontally a minimum of 60 inches from edge of wall. Install insulated grounding bushings on terminations at equipment.
        1) Stub-ups shall be minimum 4 inches above finished floor and no less than 3 inches from conduit side to edge of slab.
10. After installing first tier of duct, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand place backfill to 4 inches over duct and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction. Comply with requirements in Division 03 for installation of backfill materials.
    a. Place minimum 3 inches of sand as a bed for duct. Place sand to a minimum of 6 inches above top level of duct.
    b. Place minimum 6 inches of engineered fill above concrete encasement of duct.

M. Underground-Line Warning Tape: Bury conducting underground line specified in Section 260553 "Identification for Electrical Systems" approximately 12 inches below grade. Align tape parallel to and within 3 inches of centerline of duct bank. Provide an additional warning tape for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional tapes 12 inches apart, horizontally.

3.6 INSTALLATION OF CONCRETE MANHOLES, HANDHOLES, AND BOXES

A. Precast Concrete Handhole and Manhole Installation:
1. Comply with ASTM C891 unless otherwise indicated.
2. Install units level and plumb and with orientation and depth coordinated with connecting duct, to minimize bends and deflections required for proper entrances.

3. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

B. Elevations:

1. Manhole Roof: Install with rooftop at least 15 inches below finished grade.
2. Manhole Frame: In paved areas and trafficways, set frames flush with finished grade. Set other manhole frames 1 inch above finished grade.
3. Install handholes with bottom below frost line.
4. Handhole Covers: In paved areas and trafficways, set surface flush with finished grade. Set covers of other handholes 1 inch above finished grade.
5. Where indicated, cast handhole cover frame integrally with handhole structure.

C. Manhole Access: Circular opening in manhole roof; sized to match cover size.

1. Install chimney, constructed of precast concrete collars and rings, to support cast-iron frame to connect cover with manhole roof opening. Provide moisture-tight masonry joints and waterproof grouting for frame to chimney.

D. Waterproofing: Apply waterproofing to exterior surfaces of manholes and handholes after concrete has cured at least three days. Waterproofing materials and installation are specified in Division 07.

E. After duct has been connected and grouted, and before backfilling, waterproof joints and connections, and touch up abrasions and scars. Waterproof exterior of manhole chimneys after mortar has cured at least three days.

F. Dampproofing: Apply dampproofing to exterior surfaces of manholes and handholes after concrete has cured at least three days. Dampproofing materials and installation are specified in Division 07. After ducts are connected and grouted, and before backfilling, dampproof joints and connections, and touch up abrasions and scars. Dampproof exterior of manhole chimneys after mortar has cured at least three days.

3.7 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting duct, to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of duct, and seal joint between box and extension as recommended by manufacturer.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas and trafficways, set cover flush with finished grade. Set covers of other handholes 1 inch above finished grade.

D. Install handholes and boxes with bottom below frost line.

E. Field cut openings for duct according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

F. For enclosures installed in asphalt paving and subject to occasional, nondeliberate, heavy-vehicle loading, form and pour a concrete ring encircling, and in contact with, enclosure and with top surface screeded to top of box cover frame. Bottom of ring shall rest on compacted earth.

1. Concrete: 3000 psi, 28-day strength, complying with Section 033000 "Cast-in-Place Concrete," with a troweled finish.
2. Dimensions: 10 inches wide by 12 inches deep.

3.8 GROUNDING

A. Ground underground ducts and utility structures according to Section 260526 "Grounding and Bonding for Electrical Systems."

3.9 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Demonstrate capability and compliance with requirements on completion of installation of underground duct, duct bank, and utility structures.
2. Pull solid aluminum or wood test mandrel through duct to prove joint integrity and adequate bend radii, and test for out-of-round duct. Provide a minimum 12-inch-long mandrel equal to duct size minus 1/4 inch. If obstructions are indicated, remove obstructions and retest.
3. Test manhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Section 260526 "Grounding and Bonding for Electrical Systems."

B. Correct deficiencies and retest as specified above to demonstrate compliance.

C. Prepare test and inspection reports.

3.10 CLEANING

A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of duct until duct cleaner indicates that duct is clear of dirt and debris. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

B. Clean internal surfaces of manholes, including sump.

1. Sweep floor, removing dirt and debris.
2. Remove foreign material.

END OF SECTION

SECTION 260544

SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

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 sleeves.
2. Sleeve seal systems.
3. Grout.
4. Pourable sealants.
5. Foam sealants.

B. Related Requirements:

1. Division 07 for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 ROUND SLEEVES

A. Wall Sleeves, Steel:

1. Description: ASTM A53/A53M, Type E, Grade B, Schedule 40, zinc coated, plain ends and integral waterstop.

B. Wall Sleeves, Cast Iron:

1. Description: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop.

C. Pipe Sleeves, PVC:

1. Description: ASTM D1785, Schedule 40.

D. Molded Sleeves, PVC:

1. Description: With nailing flange for attaching to wooden forms.

E. Molded Sleeves, PE or PP:

1. Description: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

F. Sheet Metal Sleeves, Galvanized Steel, Round:

1. Description: Galvanized-steel sheet; thickness not less than 0.0239-inch; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

2.2 SLEEVE SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable or between raceway and cable.

1. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

2. Pressure Plates: Carbon steel.
3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating of length required to secure pressure plates to sealing elements.

2.3 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
1. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

2.4 POURABLE SEALANTS

A. Description: Single-component, neutral-curing elastomeric sealants of grade indicated below.
1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.

2.5 FOAM SEALANTS

A. Description: Multicomponent, liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam. Foam expansion must not damage cables or crack penetrated structure.

PART 3 - EXECUTION

3.1 INSTALLATION OF SLEEVES FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.
B. Sleeves for Conduits Penetrating Above-Grade, Non-Fire-Rated, Concrete and Masonry-Unit Floors and Walls:
1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
a. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall or floor so no voids remain. Tool exposed surfaces smooth; protect material while curing.
b. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07.
2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable, unless sleeve seal system is to be installed.
4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.
C. Sleeves for Conduits Penetrating Non-Fire-Rated Wall Assemblies:
1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
2. Seal space outside of sleeves with approved joint compound for wall assemblies.
D. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

E. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seal systems. Size sleeves to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

F. Underground, Exterior-Wall and Floor Penetrations:

1. Install cast-iron pipe sleeves with integral waterstops. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve seal system. Install sleeve during construction of floor or wall.

2. Install steel pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve seal system. Grout sleeve into wall or floor opening.

3.2 INSTALLATION OF SLEEVE SEAL SYSTEMS

A. Install sleeve seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

END OF SECTION

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SECTION 260553
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Labels.
2. Tapes and stencils.
3. Tags.
4. Signs.
5. Cable ties.
6. Miscellaneous identification products.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for electrical identification products.

B. Delegated-Design Submittal: For arc-flash hazard study.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with ASME A13.1 and IEEE C2.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Comply with NFPA 70E and Section 260573.19 "Arc-Flash Hazard Analysis" requirements for arc-flash warning labels.

F. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

2.2 COLOR AND LEGEND REQUIREMENTS

A. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder and branch-circuit conductors.

1. Color shall be factory applied or field applied for sizes larger than No. 8 AWG if authorities having jurisdiction permit.
2. Colors for 208/120-V Circuits:
   a. Phase A: Black.
   b. Phase B: Red.
   c. Phase C: Blue.
3. Colors for 480/277-V Circuits:
   a. Phase A: Brown.
   b. Phase B: Orange.

c. Phase C: Yellow.

4. Color for Neutral: White.

5. Color for Equipment Grounds: Green.

B. Warning labels and signs shall include, but are not limited to, the following legends:

1. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

C. Equipment Identification Labels:

1. Black letters on a white field.

2.3 LABELS

A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.

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. Brady Corporation.

b. LEM Products Inc.

c. Panduit Corp.

B. Self-Adhesive Wraparound Labels: Preprinted or write-on, 3-mil-thick, polyester or vinyl flexible label with acrylic pressure-sensitive adhesive.

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. Brady Corporation.

b. LEM Products Inc.

c. Panduit Corp.

2. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized such that the clear shield overlaps the entire printed legend.

3. Marker for Labels:

a. Permanent, waterproof, black ink marker recommended by tag manufacturer.

b. Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.

C. Self-Adhesive Labels: Polyester or vinyl, thermal, transfer-printed, 3-mil-thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.

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. Brady Corporation.

b. LEM Products Inc.

c. Panduit Corp.

2. Minimum Nominal Size:
    a. 1-1/2 by 6 inches for raceway and conductors.
    b. 3-1/2 by 5 inches for equipment.
    c. As required by authorities having jurisdiction.

2.4 TAPES AND STENCILS

A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
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. Ideal Industries, Inc.
    b. Panduit Corp.

B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils thick by 1 to 2 inches wide; compounded for outdoor use.
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. Brady Corporation.

C. Tape and Stencil: 4-inch-wide black stripes on 10-inch centers placed diagonally over orange background and are 12 inches wide. Stop stripes at legends.
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. LEM Products Inc.

D. Floor Marking Tape: 2-inch-wide, 5-mil pressure-sensitive vinyl tape, with yellow and black stripes and clear vinyl overlay.
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. Carlton Industries, LP.

E. Underground-Line Warning Tape:
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. Brady Corporation.
    b. Ideal Industries, Inc.
    c. LEM Products Inc.
2. Tape:
    a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical utility lines.
    b. Printing on tape shall be permanent and shall not be damaged by burial operations.
    c. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.

3. Color and Printing:
    a. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535.4, and ANSI Z535.5.
    b. Inscriptions for Red-Colored Tapes: "ELECTRIC LINE, HIGH VOLTAGE".
4. Type ID:
    a. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core; bright colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
    b. Width: 3 inches.
    c. Overall Thickness: 5 mils.
    d. Foil Core Thickness: 0.35 mil.
    e. Weight: 28 lb/1000 sq. ft.
    f. Tensile according to ASTM D882: 70 lbf and 4600 psi.

F. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

2.5 TAGS

A. Nonmetallic Preprinted Tags: Polyethylene tags**, 0.015 inch** thick, color-coded for phase and voltage level, with factory printed permanent designations; punched for use with self-locking cable tie fastener.
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. Brady Corporation.
    b. LEM Products Inc.
    c. Panduit Corp.

B. Write-on Tags:
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. LEM Products Inc.
2. Polyester Tags: 0.010 inch thick, with corrosion-resistant grommet and cable tie for attachment.
3. Marker for Tags:
    a. Permanent, waterproof, black ink marker recommended by tag manufacturer.
    b. Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.6 SIGNS

A. Laminated Acrylic or Melamine Plastic Signs:
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. Brady Corporation.
    b. Carlton Industries, LP.

2. Engraved legend.
3. Thickness:
    a. For signs up to 20 sq. in., minimum 1/16 inch thick.
    b. For signs larger than 20 sq. in., 1/8 inch thick.
    c. Engraved legend with black letters on white face.
    d. Punched or drilled for mechanical fasteners with 1/4-inch grommets in corners for mounting or self-adhesive.

2.7 CABLE TIES

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. Ideal Industries, Inc.
    2. Panduit Corp.

B. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.
    1. Minimum Width: 3/16 inch.
    2. Tensile Strength at 73 Deg F according to ASTM D638: 12,000 psi.
    3. Temperature Range: Minus 40 to plus 185 deg F.
    4. Color: Black, except where used for color-coding.

C. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.
    1. Minimum Width: 3/16 inch.
    2. Tensile Strength at 73 Deg F according to ASTM D638: 12,000 psi.
    3. Temperature Range: Minus 40 to plus 185 deg F.
    4. Color: Black.

D. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, and self-locking.
    1. Minimum Width: 3/16 inch.
    2. Tensile Strength at 73 Deg F according to ASTM D638: 7000 psi.
    3. UL 94 Flame Rating: 94V-0.
    4. Temperature Range: Minus 50 to plus 284 deg F.
    5. Color: Black.

2.8 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 PREPARATION

A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.2 INSTALLATION

A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

B. Install identifying devices before installing acoustical ceilings and similar concealment.

C. Verify identity of each item before installing identification products.

D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

E. Apply identification devices to surfaces that require finish after completing finish work.

F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.

G. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

H. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.

I. Vinyl Wraparound Labels:

1. Secure tight to surface of raceway or cable at a location with high visibility and accessibility.
2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.

J. Self-Adhesive Wraparound Labels: Secure tight to surface at a location with high visibility and accessibility.

K. Self-Adhesive Labels:

1. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.

L. Marker Tapes: Secure tight to surface at a location with high visibility and accessibility.

M. Self-Adhesive Vinyl Tape: Secure tight to surface at a location with high visibility and accessibility.

1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.

N. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.

O. Floor Marking Tape: Apply stripes to finished surfaces following manufacturer's written instructions.

P. Underground Line Warning Tape:

1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches overall.
2. Install underground-line warning tape for direct-buried cables and cables in raceways.

Q. Nonmetallic Preprinted Tags:

1. Place in a location with high visibility and accessibility.
2. Secure using cable ties.

R. Write-on Tags:

1. Place in a location with high visibility and accessibility.
2. Secure using cable ties.

S. Laminated Acrylic or Melamine Plastic Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high sign; where two lines of text are required, use labels 2 inches high.

T. Cable Ties: General purpose, for attaching tags, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

3.3 IDENTIFICATION SCHEDULE

A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.

B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.

C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use vinyl wraparound labels, self-adhesive wraparound labels or self-adhesive vinyl tape to identify the phase.

1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

D. Power-Circuit Conductor Identification, More Than 600 V: For conductors in vaults, pull and junction boxes, manholes, and handholes, **use write-on tags or nonmetallic preprinted tags colored and marked to indicate phase, and a separate tag with the circuit designation.**

E. Conductors to Be Extended in the Future: Attach write-on tags or marker tape to conductors and list source.

F. Locations of Underground Lines: Underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.

G. Workspace Indication: Apply floor marking tape or tape and stencil to finished surfaces. Show working clearances in the direction of access to live parts. Workspace shall comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

H. Instructional Signs: Self-adhesive labels, including the color code for grounded and ungrounded conductors.

I. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive labels.

1. Apply to exterior of door, cover, or other access.

J. Arc Flash Warning Labeling: Self-adhesive labels.

K. Equipment Identification Labels:

1. Indoor Equipment: Self-adhesive label or laminated acrylic or melamine plastic sign.
2. Outdoor Equipment: Laminated acrylic or melamine sign.
3. Equipment to Be Labeled:
   a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be in the form of a self-adhesive, engraved, laminated acrylic or melamine label.
   b. Enclosures and electrical cabinets.
   c. Access doors and panels for concealed electrical items.
   d. Switchboards.
   e. Transformers: Label that includes tag designation indicated on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
   f. Enclosed switches.
   g. Enclosed circuit breakers.

END OF SECTION

SECTION 260573.13
SHORT-CIRCUIT STUDIES

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 a computer-based, fault-current study to determine the minimum interrupting capacity of circuit protective devices.

1.3 DEFINITIONS

A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed and salvaged, or removed and reinstalled. Existing to remain items shall remain functional throughout the construction period.

B. One-Line Diagram: A diagram that shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

C. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion of the circuit from the system.

D. SCCR: Short-circuit current rating.

E. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

F. Single-Line Diagram: See "One-Line Diagram."

1.4 ACTION SUBMITTALS

A. Product Data:

1. Submit the following after the approval of system protective devices submittals. Submittals may be in digital form.

   a. Short-circuit study input data, including completed computer program input data sheets.

   b. Short-circuit study and equipment evaluation report; signed, dated, and sealed by a qualified professional engineer.

      1) Submit study report for action prior to receiving final approval of distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.

      2) Revised one-line diagram, reflecting field investigation results and results of short-circuit study.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:

1. For overcurrent protective devices to include in emergency, operation, and maintenance manuals.

2. The following are from the Short-Circuit Study Report:

   a. Final one-line diagram.

   b. Final Short-Circuit Study Report.

   c. Short-circuit study data files.

d. Power system data.

1.6 QUALITY ASSURANCE

A. Study shall be performed using commercially developed and distributed software designed specifically for power system analysis.

B. Software algorithms shall comply with requirements of standards and guides specified in this Section.

C. Manual calculations are unacceptable.

PART 2 - PRODUCTS

2.1 SHORT-CIRCUIT STUDY REPORT CONTENTS

A. Executive summary of study findings.

B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.

C. One-line diagram of modeled power system, showing the following:

1. Protective device designations and ampere ratings.
2. Conductor types, sizes, and lengths.
3. Transformer kilovolt ampere (kVA) and voltage ratings.
4. Motor and generator designations and kVA ratings.
5. Switchgear, switchboard, motor-control center, and panelboard designations and ratings.
6. Derating factors and environmental conditions.
7. Any revisions to electrical equipment required by the study.

D. Comments and recommendations for system improvements or revisions in a written document, separate from one-line diagram.

E. Protective Device Evaluation:

1. Evaluate equipment and protective devices and compare to available short-circuit currents. Verify that equipment withstand ratings exceed available short-circuit current at equipment installation locations.
2. Tabulations of circuit breaker, fuse, and other protective device ratings versus calculated short-circuit duties.
3. For 600-V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
4. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in standards to 1/2-cycle symmetrical fault current.
5. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.

F. Short-Circuit Study Input Data:

1. One-line diagram of system being studied.
2. Power sources available.
3. Manufacturer, model, and interrupting rating of protective devices.
4. Conductors.
5. Transformer data.

G. Short-Circuit Study Output Reports:

1. Low-Voltage Fault Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

   a. Voltage.

   b. Calculated fault-current magnitude and angle.

   c. Fault-point X/R ratio.

   d. Equivalent impedance.

2. Momentary Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

   a. Voltage.

   b. Calculated symmetrical fault-current magnitude and angle.

   c. Fault-point X/R ratio.

   d. Calculated asymmetrical fault currents:

      1) Based on fault-point X/R ratio.

      2) Based on calculated symmetrical value multiplied by 1.6.

      3) Based on calculated symmetrical value multiplied by 2.7.

3. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

   a. Voltage.

   b. Calculated symmetrical fault-current magnitude and angle.

   c. Fault-point X/R ratio.

   d. No AC Decrement (NACD) ratio.

   e. Equivalent impedance.

   f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.

   g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.

PART 3 - EXECUTION

3.1 POWER SYSTEM DATA

A. Obtain all data necessary for conduct of the study.

1. Verify completeness of data supplied on one-line diagram. Call any discrepancies to Architect's attention.

2. For equipment included as Work of this Project, use characteristics submitted under provisions of action submittals and information submittals for this Project.

3. For equipment that is existing to remain, obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers. Qualifications of technicians and engineers shall be as defined by NFPA 70E.

B. Gather and tabulate the required input data to support the short-circuit study. Comply with requirements in Division 01 for recording circuit protective device characteristics. Record data on a Record Document copy of one-line diagram. Comply with recommendations in IEEE 551 as to the amount of detail that is required to be acquired in the field. Data include, but are not limited to, the following:

1. Product Data for Project's overcurrent protective devices involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.

2. Obtain electrical power utility impedance at the service.
3. Power sources and ties.
4. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
5. For reactors, provide manufacturer and model designation, voltage rating, and impedance.
6. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip, SCCR, current rating, and breaker settings.
7. Motor horsepower and NEMA MG 1 code letter designation.
8. Conductor sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).
9. Derating factors.

3.2 SHORT-CIRCUIT STUDY

A. Perform study following the general study procedures contained in IEEE 399.

B. Calculate short-circuit currents according to IEEE 551.

C. Base study on device characteristics supplied by device manufacturer.

D. Extent of electrical power system to be studied is indicated on Drawings.

E. Begin short-circuit current analysis at the service, extending down to system overcurrent protective devices as follows:

1. To normal system low-voltage load buses where fault current is 10 kA or less.

F. Study electrical distribution system from normal power source throughout electrical distribution system for Project. Study all cases of system-switching configurations and alternate operations that could result in maximum fault conditions.

G. Include the ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and apply to low- and medium-voltage, three-phase ac systems. Also account for the fault-current dc decrement to address asymmetrical requirements of interrupting equipment.

H. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault and a single line-to-ground fault at each equipment indicated on one-line diagram.

1. For grounded systems, provide a bolted line-to-ground fault-current study for areas as defined for the three-phase bolted fault short-circuit study.

I. Include in the report identification of any protective device applied outside its capacity.

END OF SECTION

SECTION 260573.19

ARC-FLASH HAZARD ANALYSIS

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 a computer-based, arc-flash study to determine the arc-flash hazard distance and the incident energy to which personnel could be exposed during work on or near electrical equipment.

1.3 DEFINITIONS

A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

B. One-Line Diagram: A diagram that shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

C. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.

D. SCCR: Short-circuit current rating.

E. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

F. Single-Line Diagram: See "One-Line Diagram."

1.4 ACTION SUBMITTALS

A. Study Submittals: Submit the following submittals after the approval of system protective devices submittals. Submittals may be in digital form:

1. Arc-flash study input data, including completed computer program input data sheets.
2. Arc-flash study report; signed, dated, and sealed by qualified professional engineer.
3. Submit study report for action prior to receiving final approval of distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:

1. Provide maintenance procedures in equipment manuals according to requirements in NFPA 70E.
2. Operation and Maintenance Procedures: In addition to items specified in Division 01 provide maintenance procedures for use by Owner's personnel that comply with requirements in NFPA 70E.

1.6 QUALITY ASSURANCE

A. Study shall be performed using commercially developed and distributed software designed specifically for power system analysis.

B. Software algorithms shall comply with requirements of standards and guides specified in this Section.

C. Manual calculations are unacceptable.

D. Arc-Flash Study Certification: Arc-Flash Study Report shall be signed and sealed by qualified professional engineer.

PART 2 - PRODUCTS

2.1 ARC-FLASH STUDY REPORT CONTENT

A. Executive summary of study findings.

B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.

C. One-line diagram, showing the following:

1. Protective device designations and ampere ratings.
2. Conductor types, sizes, and lengths.
3. Transformer kilovolt ampere (kVA) and voltage ratings, including derating factors and environmental conditions.
4. Motor and generator designations and kVA ratings.
5. Switchgear, switchboard, motor-control center, panelboard designations, and ratings.

D. Study Input Data: As described in "Power System Data" Article.

E. Short-Circuit Study Output Data: As specified in "Short-Circuit Study Output Reports" Paragraph in "Short-Circuit Study Report Contents" Article in Section 260573.13 "Short-Circuit Studies."

F. Arc-Flash Study Output Reports:

1. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each equipment location included in the report:
   a. Voltage.
   b. Calculated symmetrical fault-current magnitude and angle.
   c. Fault-point X/R ratio.
   d. No AC Decrement (NACD) ratio.
   e. Equivalent impedance.
   f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
   g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.

G. Incident Energy and Flash Protection Boundary Calculations:

1. Arcing fault magnitude.
2. Protective device clearing time.
3. Duration of arc.
4. Arc-flash boundary.
5. Restricted approach boundary.
6. Limited approach boundary.
7. Working distance.
8. Incident energy.
9. Hazard risk category.
10. Recommendations for arc-flash energy reduction.

H. Fault study input data, case descriptions, and fault-current calculations including a definition of terms and guide for interpretation of computer printout.

2.2 ARC-FLASH WARNING LABELS

A. Comply with requirements in Section 260553 "Identification for Electrical Systems" for self-adhesive equipment labels. Produce a 3.5-by-5-inch self-adhesive equipment label for each work location included in the analysis.

B. Label shall have an orange header with the wording, "WARNING, ARC-FLASH HAZARD," and shall include the following information taken directly from the arc-flash hazard analysis:

1. Location designation.
2. Nominal voltage.
3. Protection boundaries.
   a. Arc-flash boundary.
   b. Restricted approach boundary.
   c. Limited approach boundary.
4. Arc flash PPE category.
5. Required minimum arc rating of PPE in Cal/cm squared.
6. Available incident energy.
7. Working distance.
8. Engineering report number, revision number, and issue date.

C. Labels shall be machine printed, with no field-applied markings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Project overcurrent protective device submittals. Proceed with arc-flash study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to arc-flash study may not be used in study.

3.2 ARC-FLASH HAZARD ANALYSIS

A. Comply with NFPA 70E and its Annex D for hazard analysis study.

B. Preparatory Studies: Perform the Short-Circuit study prior to starting the Arc-Flash Hazard Analysis.

1. Short-Circuit Study Output: As specified in "Short-Circuit Study Output Reports" Paragraph in "Short-Circuit Study Report Contents" Article in Section 260573.13 "Short-Circuit Studies."

C. Calculate maximum and minimum contributions of fault-current size.

1. Maximum calculation shall assume a maximum contribution from the utility and shall assume motors to be operating under full-load conditions.
2. Calculate arc-flash energy at 85 percent of maximum short-circuit current according to IEEE 1584 recommendations.
3. Calculate arc-flash energy at 38 percent of maximum short-circuit current according to NFPA 70E recommendations.
4. Calculate arc-flash energy with the utility contribution at a minimum and assume no motor contribution.

D. Calculate the arc-flash protection boundary and incident energy at locations in electrical distribution system where personnel could perform work on energized parts.

E. Include medium- and low-voltage equipment locations.

F. Calculate the limited, restricted, and prohibited approach boundaries for each location.

G. Incident energy calculations shall consider the accumulation of energy over time when performing arc-flash calculations on buses with multiple sources. Iterative calculations shall take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators shall be decremented as follows:

1. Fault contribution from induction motors shall not be considered beyond three to five cycles.
2. Fault contribution from synchronous motors and generators shall be decayed to match the actual decrement of each as closely as possible (for example, contributions from permanent magnet generators will typically decay from 10 per unit to three per unit after 10 cycles).

H. Arc-flash energy shall generally be reported for the maximum of line or load side of a circuit breaker. However, arc-flash computation shall be performed and reported for both line and load side of a circuit breaker as follows:

1. When the circuit breaker is in a separate enclosure.
2. When the line terminals of the circuit breaker are separate from the work location.

I. Base arc-flash calculations on actual overcurrent protective device clearing time. Cap maximum clearing time at two seconds based on IEEE 1584, Section B.1.2.

3.3 POWER SYSTEM DATA

A. Obtain all data necessary for conduct of the arc-flash hazard analysis.

1. Verify completeness of data supplied on one-line diagram on Drawings. Call discrepancies to Architect's attention.
2. For new equipment, use characteristics from approved submittals under provisions of action submittals and information submittals for this Project.
3. For existing equipment, whether or not relocated, obtain required electrical distribution system data by field investigation and surveys conducted by qualified technicians and engineers.

B. Electrical Survey Data: Gather and tabulate the following input data to support study. Comply with recommendations in IEEE 1584 and NFPA 70E as to the amount of detail that is required to be acquired in the field. Data include, but are not limited to, the following:

1. Product Data for overcurrent protective devices specified in other Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Obtain electrical power utility impedance or available short circuit current at the service.
3. Power sources and ties.
4. Short-circuit current at each system bus (three phase and line to ground).
5. Full-load current of all loads.
6. Voltage level at each bus.
7. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
8. For reactors, provide manufacturer and model designation, voltage rating and impedance.
9. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip and available range of settings, SCCR, current rating, and breaker settings.
10. For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.

11. Motor horsepower and NEMA MG 1 code letter designation.
12. Low-voltage conductor sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).
13. Medium-voltage conductor sizes, lengths, conductor material, conductor construction and metallic shield performance parameters, and conduit material (magnetic or nonmagnetic).

3.4 LABELING

A. Apply one arc-flash label on the front cover of each section of the equipment and on side or rear covers with accessible live parts and hinged doors or removable plates for each equipment included in the study. Base arc-flash label data on highest values calculated at each location.

B. Each piece of equipment listed below shall have an arc-flash label applied to it:

1. Motor-control center.
2. Low-voltage switchboard.
3. Medium voltage transformers
4. Low voltage transformers.
5. Panelboard and safety switch

C. Note on record Drawings the location of equipment where the personnel could be exposed to arc-flash hazard during their work.

1. Indicate arc-flash energy.
2. Indicate protection level required.

END OF SECTION

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SECTION 260923
LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Lighting control relay panels.
   2. Daylight sensors.
   3. Indoor occupancy sensors.
   4. Switches.
   5. Room controllers.
   6. Power packs.
   7. Bluetooth radio controller.

B. Related Requirements:
   1. Section 262726 "Wiring Devices" for manual light switches.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:
   1. Show installation details for the following:
      a. Panels.
      b. Sensors.
      c. Switches.
      d. Room controllers.
      e. Power packs.
   2. Interconnection diagrams showing field-installed wiring.
   3. Include diagrams for power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of lighting control device to include in operation and maintenance manuals.

1.5 WARRANTY

A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace lighting control devices that fail(s) in materials or workmanship within specified warranty period.
   1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Hubbell Building Automation, Inc or comparable product

2.2 LIGHTING CONTROL RELAY PANELS

A. Lighting Control Panel:

1. Tag LCP1: NXP-EIT-8-4-UNV-S.
2. Tag LCP2: NXP-EIT-24-20-UNV-S.
3. Lighting control panels located in the Processing Area shall be installed in an airconditioned NEMA 12 enclosure, Hoffman or equal. Air conditioner shall be sized as required to maintain temperature as recommended by manufacturer.

2.3 DAYLIGHT SENSORS

A. Daylight Sensors:

1. Tag DS: Indoor, NXDS.

2.4 INDOOR OCCUPANCY SENSORS

A. Dual-Technology Type:
1. Tag OS1: Ceiling, low-voltage, OMNIDT2000.
2. Tag OS2: Ceiling, NXOS-OM-DT2.

B. Device Color: As specified in Section 262726 "Wiring Devices."

C. Wall Plates: Single and multigang plates as specified in Section 262726 "Wiring Devices."

D. Legend: Engraved or permanently silk-screened on wall plate to indicate function. Submit proposed text to Owner for review and approval.

2.5 SWITCHES

A. Tag SDO: LHDMIRS3-N.

B. Tag SO: LHMTS1-G.

C. Tag SRL: On/Raise/Lower/Off, NXSW-ORLO.

D. Tag 1B: One button, NXSW-1.

E. Device Color: As specified in Section 262726 "Wiring Devices."

F. Wall Plates: Single and multigang plates as specified in Section 262726 "Wiring Devices."

G. Legend: Engraved or permanently silk-screened on wall plate to indicate function. Submit proposed text to Owner for review and approval.

2.6 ROOM CONTROLLERS

A. Tag RC: NXRCFX-1RD-UNV.

2.7 POWER PACKS

A. UVPP.

2.8 BLUETOOTH RADIO CONTROLLER

A. NXBTC.

2.9 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Control cables shall be as recommended by manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine lighting control devices before installation. Reject lighting control devices that are wet, moisture damaged, or mold damaged.

B. Examine walls and ceilings for suitable conditions where lighting control devices will be installed.

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

3.2 INSTALLATION OF SENSORS

A. Comply with NECA 1.

B. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.

C. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.3 INSTALLATION OF CONTACTORS

A. Comply with NECA 1.

3.4 INSTALLATION OF WIRING

A. Comply with NECA 1.

B. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch.

C. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors in accordance with conductor manufacturer's written instructions.

D. Size conductors in accordance with lighting control device manufacturer's written instructions unless otherwise indicated.

E. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.5 IDENTIFICATION

A. Identify components and power and control wiring in accordance with Section 260553 "Identification for Electrical Systems.

1. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.

3.6 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform the following tests and inspections:

1. Operational Test: After installation, and after electrical circuitry has been energized, start units to confirm proper unit operation.

2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Lighting control devices will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.7 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting lighting control devices to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.

2. For daylighting controls, adjust set points and deadband controls to suit Owner's operations.

END OF SECTION

SECTION 261219

PAD-MOUNTED, LIQUID-FILLED, MEDIUM-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes pad-mounted, liquid-filled, medium-voltage distribution transformers, with primary and secondary bushings within or without air-terminal enclosures.

1.3 DEFINITIONS

A. BIL: Basic Impulse Insulation Level.

B. Bushing: An insulating structure including a central conductor, or providing a central passage for a conductor, with provision for mounting on a barrier, conducting or otherwise, for the purpose of insulating the conductor from the barrier and conducting current from one side of the barrier to the other.

C. Bushing Elbow: An insulated device used to connect insulated conductors to separable insulated connectors on dead-front, pad-mounted transformers and to provide a fully insulated connection. This is also called an "elbow connector."

D. Bushing Insert: That component of a separable insulated connector that is inserted into a bushing well to complete a dead-front, load break or nonload break, separable insulated connector (bushing).

E. Bushing Well: A component of a separable insulated connector, either permanently welded or clamped to an enclosure wall or barrier, having a cavity that receives a replaceable component (bushing insert) to complete the separable insulated connector (bushing).

F. Elbow Connector: See "bushing elbow" above.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, and furnished specialties and accessories.

B. Shop Drawings: For pad-mounted, liquid-filled, medium-voltage transformers.

1. Include plans and elevations showing major components and features.

a. Include a plan view and cross section of equipment base, showing clearances, required workspace, and locations of penetrations for grounding and conduits.

2. Include details of equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

3. Include single-line diagram.

4. Include list of materials.

5. Include nameplate data.

6. Manufacturer's published time-current curves of the transformer high-voltage fuses, with transformer damage curve, inrush curve, and thru fault current indicated.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: For transformers, signed by product manufacturer.

B. Source quality-control reports.

C. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For transformer and accessories to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with IEEE C2.

C. Comply with IEEE C57.12.00.

2.2 PERFORMANCE REQUIREMENTS

A. Windings Material: Copper.

B. Surge Arresters: Comply with IEEE C62.11, Distribution Class; metal-oxide-varistor type, fully shielded, separable-elbow type, suitable for plugging into the inserts provided in the high-voltage section of the transformer. Connected in each phase of incoming circuit and ahead of any disconnecting device.

C. Winding Connections: The connection of windings and terminal markings shall comply with IEEE C57.12.70.

D. Efficiency: Comply with 10 CFR 431, Subpart K.

E. Insulation: Transformer kVA rating shall be as follows: The average winding temperature rise above a 30 deg C ambient temperature shall not exceed 65 deg C and 80 deg C hottest-spot temperature rise at rated kVA when tested according to IEEE C57.12.90, using combination of connections and taps that give the highest average winding temperature rise.

F. Tap Changer: External handle, for de-energized operation.

G. Tank: Sealed, with welded-on cover.

H. Enclosure Integrity: Comply with IEEE C57.12.28 for pad-mounted enclosures that contain energized electrical equipment in excess of 600 V that may be exposed to the public.

I. Mounting: An integral skid mounting frame, suitable to allow skidding or rolling of transformer in any direction, and with provision for anchoring frame to pad.

J. Insulating Liquids:

1. Mineral Oil: ASTM D3487, Type II, and tested for compliance with ASTM D117.

K. Sound level shall comply with NEMA TR 1 requirements.

L. Corrosion Protection:

1. Transformer coating system shall be factory applied, complying with requirements of IEEE C57.12.28 or IEEE C57.12.29, in manufacturer's standard color green.

2.3 THREE-PHASE TRANSFORMERS

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. Cooper Industries, Inc.
2. Eaton.
3. GE Power; General Electric Company.
4. Hitachi ABB Power Grids Ltd.; ABB & Hitachi Joint Venture.

B. Description:

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2. Comply with IEEE C57.12.26.

C. Compartment Construction:

1. Double-Compartment Construction: Individual compartments for high- and low-voltage sections, formed by steel isolating barriers that extend full height and depth of compartments, with hinged, lift-off doors and three-point latching, with a stop in the open position and provision for padlocking.

D. Primary Fusing: Designed and rated to provide thermal protection of transformer by sensing overcurrent and high liquid temperature.

1. 150-kV BIL current-limiting fuses, conforming to requirements of IEEE C37.47.

2. Interrupting Rating: 50,000 rms A symmetrical at system voltage.

3. Fuse Assembly: Bayonet-type, liquid-immersed, expulsion fuses in series with liquid-immersed, partial-range, current-limiting fuses. Bayonet fuse shall sense both high currents and high oil temperature to provide thermal protection to the transformer. Connect current-limiting fuses ahead of radial-feed load-break switch.

4. Provide bayonet fuse assembly with an oil retention valve and an external drip shield inside the housing to eliminate or minimize oil spills. Valve shall close when fuse holder is removed and an external drip shield is installed.

5. Provide a conspicuously displayed warning adjacent to bayonet fuse(s), cautioning against removing or inserting fuses unless transformer has been de-energized and tank pressure has been released.

E. High-Voltage Section: Dead-front design.

1. To connect primary cable, use separable insulated connectors; coordinated with and complying with requirements of Section 260513 "Medium-Voltage Cables." Bushings shall be one-piece units, with ampere and BIL ratings the same as connectors.

2. Bushing inserts:

a. Conform to the requirements of IEEE 386.

b. Rated at 200 A, with voltage class matching connectors. Provide a parking stand near each bushing well. Parking stands shall be equipped with insulated standoff bushings for parking of energized load-break elbow connectors on parking stands.

c. Provide insulated protective caps for insulating and sealing out moisture from unused bushing inserts and insulated standoff bushings.

3. Bushing wells configured for loop-feed application.

4. Access to liquid-immersed fuses.

5. Dead-front surge arresters.

6. Tap-changer operator.

7. Load-Break Switch:

a. Radial-feed, liquid-immersed type with voltage class and BIL matching that of separable connectors, with a continuous current rating and load-break rating of 200 amperes, and a make-and-latch rating of 12 kA rms symmetrical.

8. Ground pad.

F. Low-Voltage Section:

1. Bushings with spade terminals drilled for terminating the number of conductors indicated on the Drawings, and the lugs that comply with requirements of Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

G. Characteristics:

1. Taps: Comply with IEEE C57.12.26 requirements.
2. Transformer BIL (kV): Comply with IEEE C57.12.26 requirements.
3. Minimum Tested Impedance (Percent at 85 deg C): 5.75.
4. Comply with FM Global Class No. 3990.
5. Comply with UL listing requirements for combination classification and listing for transformer and less-flammable insulating liquid.

H. Transformer Accessories:

1. Drain and filter connection.
2. Filling and top filter press connections.
3. Pressure-vacuum gauge.
4. Dial-type analog thermometer with alarm contacts.
5. Magnetic liquid level indicator with high and low alarm contacts.
6. Automatically resetting pressure-relief device. Device flow shall be as recommended by manufacturer.
7. Stainless-steel ground connection pads.
8. Machine-engraved nameplate, made of anodized aluminum or stainless steel.
9. Sudden pressure relay for remote alarm or trip when internal transformer pressure rises at field-set rate. Provide with seal-in delay.

2.4 SERVICE CONDITIONS

A. Transformers shall be suitable for operation under service conditions specified as usual service conditions in IEEE C57.12.00.

2.5 WARNING LABELS AND SIGNS

A. Comply with requirements for labels and signs specified in Section 260553 "Identification for Electrical Systems."

1. High-Voltage Warning Label: Provide self-adhesive warning signs on outside of high-voltage compartment door(s). Sign legend shall be "DANGER HIGH VOLTAGE" printed in two lines of nominal 2-inch-high letters. The word "DANGER" shall be in white letters on a red background and the words "HIGH VOLTAGE" shall be in black letters on a white background.
2. Arc Flash Warning Label: Provide self-adhesive warning signs on outside of high-voltage compartment door(s), warning of potential electrical arc flash hazards and appropriate personal protective equipment required.

2.6 SOURCE QUALITY CONTROL

A. Provide manufacturer's certificate that the transformer design tests comply with IEEE C57.12.90.

1. Perform the following factory-certified routine tests on each transformer for this Project:
   a. Resistance.
   b. Turns ratio, polarity, and phase relation.
   c. Transformer no-load losses and excitation current at 100 percent of ratings.

d. Transformer impedance voltage and load loss.

e. Operation of all devices.

f. Lightning impulse.

g. Low frequency.

h. Leak.

i. Transformer no-load losses and excitation current at 110 percent of ratings.

j. Insulation power factor.

k. Applied potential, except that this test is not required for single-phase transformers or for three-phase Y-Y-connected transformers.

l. Induced potential.

m. Resistance measurements of all windings on rated voltage connection and at tap extreme connections.

n. Ratios on rated voltage connection and at tap extreme connections.

o. Polarity and phase relation on rated voltage connection.

p. No-load loss at rated voltage on rated voltage connection.

q. Exciting current at rated voltage on rated voltage connection.

r. Impedance.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine pad-mounted, liquid-filled, medium-voltage transformers upon delivery.

1. Upon delivery of transformers and prior to unloading, inspect equipment for any damage that may have occurred during shipment or storage.

2. Verify that tie rods and chains are undamaged and tight, and that all blocking and bracing is tight. Verify that there is no evidence of load shifting in transit, and that readings from transportation shock recorders, if equipped, are within manufacturer's recommendations.

3. Verify that there is no indication of external damage and no dents or scratches in doors and sill, tank walls, radiators and fins, or termination provisions.

4. Verify that there is no evidence of insulating-liquid leakage on transformer surfaces, at weld seams, on high- or low-voltage bushing parts, and at transformer base.

5. Verify that there is positive pressure or vacuum on tank. Check pressure gauge; it is required to read other than zero.

6. Compare transformers and accessories received with bill of materials to verify that shipment is complete. Verify that transformers and accessories conform with manufacturer's quotation and shop drawings. If shipment is incomplete or does not comply with Project requirements, notify manufacturer in writing immediately.

7. Verify presence of polychlorinated biphenyl content labeling.

8. Unload transformers carefully, observing all packing label warnings and handling instructions.

9. Open termination compartment doors and inspect components for damage or displaced parts, loose or broken connections, cracked or chipped insulators, bent mounting flanges, dirt or foreign material, and water or moisture.

B. Handling:

1. Handle transformers carefully, in accordance with manufacturer recommendations, to avoid damage to enclosure, termination compartments, base, frame, tank, and internal components. Do not subject transformers to impact, jolting, jarring, or rough handling.
2. Protect transformer termination compartments against entrance of dust, rain, and snow.
3. Transport transformers upright, to avoid internal stresses on core and coil mounting assembly and to prevent trapping air in windings. Do not tilt or tip transformers.
4. Verify that transformer weights are within rated capacity of handling equipment.
5. Use only manufacturer-recommended points for lifting, jacking, and pulling. Use all lifting lugs when lifting transformers.
6. Use jacks only at corners of tank base plate.
7. Use nylon straps of same length to balance and distribute weight when handling transformers with a crane.
8. Use spreaders or a lifting beam to obtain a vertical lift and to protect transformer from straps bearing against enclosure. Lifting cable pull angles may not be greater than 15 degrees from vertical.
9. Exercise care not to damage tank base structure when handling transformer using skids or rollers. Use skids to distribute stresses over tank base when using rollers under large transformers.

C. Storage:

1. Store transformers in accordance with manufacturer's recommendations.
2. Transformers may be stored outdoors. If possible, store transformers at final installation locations on concrete pads. If dry concrete surfaces are unavailable, use pallets of adequate strength to protect transformers from direct contact with ground. Ensure transformer is level.
3. Ensure that transformer storage location is clean and protected from severe conditions. Protect transformers from dirt, water, contamination, and physical damage. Do not store transformers in presence of corrosive or explosive gases. Protect transformers from weather when stored for more than three months.
4. Store transformers with compartment doors closed.
5. Regularly inspect transformers while in storage and maintain documentation of storage conditions, noting any discrepancies or adverse conditions. Verify that an effective pressure seal is maintained using pressure gauges. Visually check for insulating-liquid leaks and rust spots.

D. Examine areas and space conditions for compliance with requirements for pad-mounted, liquid-filled, medium-voltage transformers and other conditions affecting performance of the Work.

E. Examine roughing-in of conduits and grounding systems to verify the following:

1. Wiring entries comply with layout requirements.
2. Entries are within conduit-entry tolerances specified by manufacturer, and no feeders will cross section barriers to reach load or line lugs.

F. Examine concrete bases for suitable conditions for transformer installation.

G. Pre-Installation Checks:

1. Verify removal of any shipping bracing after placement.
2. Remove a sample of insulating liquid according to ASTM D923. Insulating-liquid values shall comply with NETA ATS, Table 100.4. Sample shall be tested for the following:
   a. Dielectric Breakdown Voltage: ASTM D877 or ASTM D1816.

b. Acid Neutralization Number: ASTM D974.

c. Specific Gravity: ASTM D1298.

d. Interfacial Tension: ASTM D971.

e. Color: ASTM D1500.

f. Visual Condition: ASTM D1524.

g. Water in Insulating Liquids: Comply with ASTM D1533.

h. Power Factor or Dissipation Factor: ASTM D924.

H. Verify that ground connections are in place and that requirements in Section 260526 "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at transformer location.

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

3.2 INSTALLATION

A. Install transformers on pre-cast concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Division 03.

B. Transformer shall be installed level and plumb and shall tilt less than 1.5 degrees while energized.

C. Maintain minimum clearances and workspace at equipment according to manufacturer's written instructions and IEEE C2.

3.3 CONNECTIONS

A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

1. For counterpoise, use tinned bare copper cable not smaller than No. 4/0 AWG, buried not less than 30 inches below grade interconnecting the grounding electrodes. Bond surge arrester and neutrals directly to transformer enclosure and then to grounding electrode system with bare copper conductors, sized as shown. Keep lead lengths as short as practicable, with no kinks or sharp bends.

2. Make joints in grounding conductors and loops by exothermic weld or compression connector.

3. Terminate all grounding and bonding conductors on a common equipment grounding terminal on transformer enclosure.

4. Complete transformer tank grounding and lightning arrester connections prior to making any other electrical connections.

B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

1. Maintain air clearances between energized live parts and between live parts and ground for exposed connections in accordance with manufacturer recommendations.

2. Bundle associated phase, neutral, and equipment grounding conductors together within transformer enclosure. Arrange conductors such that there is not excessive strain that could cause loose connections. Allow adequate slack for expansion and contraction of conductors.

C. Terminate medium-voltage cables in incoming section of transformers according to Section 260513 "Medium-Voltage Cables."

3.4 SIGNS AND LABELS

A. Comply with installation requirements for labels and signs specified in Section 260553 "Identification for Electrical Systems."

B. Install warning signs as required to comply with 29 CFR 1910.269.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform the following tests and inspections:

1. General Field-Testing Requirements:

   a. Comply with provisions of NFPA 70B Ch. "Testing and Test Methods."

   b. Perform each visual and mechanical inspection and electrical test. Certify compliance with test parameters.

   c. After installing transformer but before primary is energized, verify that grounding system at the transformer is tested at specified value or less.

   d. After installing transformer and after electrical circuitry has been energized, test for compliance with requirements.

   e. Visual and Mechanical Inspection:

      1) Verify equipment nameplate data complies with Contract Documents.

      2) Inspect bolted electrical connections for high resistance using one of the following two methods:

         a) Use a low-resistance ohmmeter to compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.

         b) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method according to manufacturer's published data or NETA ATS, Table 100.12. Bolt-torque levels shall be according to manufacturer's published data. In absence of manufacturer's published data, use NETA ATS, Table 100.12.

   f. Remove and replace malfunctioning units and retest.

   g. Prepare test and inspection reports. Record as-left set points of all adjustable devices.

2. Medium-Voltage Surge Arrester Field Tests:

   a. Visual and Mechanical Inspection:

      1) Inspect physical and mechanical condition.

      2) Verify arresters are clean.

      3) Verify that ground lead on each device is individually attached to a ground bus or ground electrode.

   b. Electrical Test:

      1) Perform an insulation-resistance test on each arrester, phase terminal-to-ground. Apply voltage according to manufacturer's published data. In the absence of manufacturer's published data, comply with NETA ATS, Table 100.1. Replace units that fail to comply with recommended minimum insulation resistance listed in that table.

      2) Perform a watts-loss test. Evaluate watts-loss values by comparison with similar units and test equipment manufacturer's published data.

3. Liquid-Filled Transformer Field Tests:

   a. Visual and Mechanical Inspection:

      1) Test dew point of tank gases if applicable.

      2) Inspect anchorage, alignment, and grounding.

3) Verify bushings are clean.

4) Verify that alarm, control, and trip settings on temperature and level indicators are set and operate within manufacturer's recommended settings.

5) Verify that liquid level in tanks is within manufacturer's published tolerances.

6) Perform specific inspections and mechanical tests recommended by manufacturer.

7) Verify presence of transformer surge arresters and that their ratings are as specified.

8) Verify that as-left tap connections are as specified.

b. Electrical Tests:

1) Perform insulation-resistance tests winding-to-winding and each winding-to-ground. Apply voltage according to manufacturer's published data. In the absence of manufacturer's published data, comply with NETA ATS, Table 100.5. Calculate polarization index; the value of the index shall not be less than 1.0.

2) Perform power-factor or dissipation-factor tests on all windings according to test equipment manufacturer's published data. Maximum winding insulation power-factor/dissipation-factor values shall be according to manufacturer's published data. In the absence of manufacturer's published data, comply with NETA ATS, Table 100.3.

3) Measure core insulation resistance at 500-V dc if the core is insulated and the core ground strap is removable. Core insulation-resistance values shall not be less than 1 megohm at 500-V dc.

4) Perform a power-factor or dissipation-factor tip-up test on windings greater than 2.5 kV.

5) Perform turns-ratio tests at tap positions. Turns-ratio test results shall not deviate by more than one-half percent from either adjacent coils or calculated ratio. If test fails, replace transformer.

6) Perform an excitation-current test on each phase. The typical excitation-current test data pattern for a three-legged core transformer is two similar current readings and one lower current reading. Investigate and correct if test shows a different pattern.

7) Measure resistance of each winding at each tap connection, and record temperature-corrected winding-resistance values in the Operations and Maintenance Manual.

8) Perform an applied-voltage test on high- and low-voltage windings-to-ground. Comply with IEEE C57.12.91, Sections 10.2 and 10.9. This test is not required for single-phase transformers and for three-phase Y-Y-connected transformers.

9) Verify correct secondary voltage, phase-to-phase and phase-to-neutral, after energization and prior to loading.

10) Remove a sample of insulating liquid according to ASTM D923, and perform dissolved-gas analysis according to IEEE C57.104 or ASTM D3612.

3.6 FOLLOW-UP SERVICE

A. Voltage Monitoring and Adjusting: After Substantial Completion, if requested by Owner, but not more than six months after Final Acceptance, perform the following voltage monitoring:

1. During a period of normal load cycles as evaluated by Owner, perform seven days of three-phase voltage recording at the outgoing section of each transformer. Use voltmeters with calibration traceable to the National Institute of Science and Technology standards and with a chart speed of not less than 1 inch per hour. Voltage unbalance greater than 1 percent between phases, or deviation of any phase voltage from the nominal value by more than plus or minus 5 percent during test period, is unacceptable.
2. Corrective Action: If test results are unacceptable, perform the following corrective action, as appropriate:
   a. Adjust transformer taps.
   b. Prepare written request for voltage adjustment by electric utility.
3. Retests: Repeat monitoring, after corrective action is performed, until satisfactory results are obtained.
4. Report:
   a. Prepare a written report covering monitoring performed and corrective action taken.

B. Infrared Inspection: Perform survey during periods of maximum possible loading. Remove all necessary covers prior to inspection.

1. After Substantial Completion, but not more than 60 days after Final Acceptance, perform infrared inspection of transformer's electrical power connections.
2. Instrument: Inspect distribution systems with imaging equipment capable of detecting a minimum temperature difference of 1 deg C at 30 deg C.
3. Record of Infrared Inspection: Prepare a certified report that identifies testing technician and equipment used, and lists results as follows:
   a. Description of equipment to be tested.
   b. Discrepancies.
   c. Temperature difference between area of concern and reference area.
   d. Probable cause of temperature difference.
   e. Areas inspected. Identify inaccessible and unobservable areas and equipment.
   f. Identify load conditions at time of inspection.
   g. Provide photographs and thermograms of deficient area.
4. Act on inspection results according to recommendations of NETA ATS, Table 100.18. Correct possible and probable deficiencies as soon as Owner's operations permit. Retest until deficiencies are corrected.

END OF SECTION

SECTION 262213

LOW-VOLTAGE DISTRIBUTION TRANSFORMERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes distribution, dry-type transformers with a nominal primary and secondary rating of 600 V and less, with capacities up to 1500 kVA.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type and size of transformer.
2. Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer.

B. Shop Drawings:

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment.
3. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Source quality-control reports.

C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For transformers to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Accredited by NETA.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Inspection: On receipt, inspect for and note any shipping damage to packaging and transformer.

1. If manufacturer packaging is removed for inspection, and transformer will be stored after inspection, re-package transformer using original or new packaging materials that provide protection equivalent to manufacturer's packaging.

B. Storage: Store in a warm, dry, and temperature-stable location in original shipping packaging.

C. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

D. Handling: Follow manufacturer's instructions for lifting and transporting transformers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Eaton.
2. Siemens Industry, Inc., Energy Management Division.
3. Square D; Schneider Electric USA.

B. Source Limitations: Obtain each transformer type from single source from single manufacturer.

2.2 GENERAL TRANSFORMER REQUIREMENTS

A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.

B. Comply with NFPA 70.

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

C. Transformers Rated 15 kVA and Larger:

1. Comply with 10 CFR 431 (DOE 2016) efficiency levels.
2. Marked as compliant with DOE 2016 efficiency levels by an NRTL.

D. Shipping Restraints: Paint or otherwise color-code bolts, wedges, blocks, and other restraints that are to be removed after installation and before energizing. Use fluorescent colors that are easily identifiable inside the transformer enclosure.

2.3 DISTRIBUTION TRANSFORMERS

A. Comply with NFPA 70, and list and label as complying with UL 1561.

B. Cores: Electrical grade, non-aging silicon steel with high permeability and low hysteresis losses.

1. One leg per phase.
2. Core volume shall allow efficient transformer operation at 10 percent above the nominal tap voltage.
3. Grounded to enclosure.

C. Coils: Continuous windings without splices except for taps.

1. Coil Material: Copper.
2. Internal Coil Connections: Brazed or pressure type.

D. Enclosure for Transformers Located in Office Area: Ventilated.

1. NEMA 250, Type 2: Core and coil shall be encapsulated within resin compound to seal out moisture and air.
2. KVA Ratings: Based on convection cooling only and not relying on auxiliary fans.
3. Wiring Compartment: Sized for conduit entry and wiring installation.
4. Finish: Comply with NEMA 250.
   a. Finish Color: Gray weather-resistant enamel.

A. Enclosure for Transformers Located in Processing Area: Totally enclosed, nonventilated.

1. NEMA 250, Type 2: Core and coil shall be encapsulated within resin compound to seal out moisture and air.
2. KVA Ratings: Based on convection cooling only and not relying on auxiliary fans.
3. Wiring Compartment: Sized for conduit entry and wiring installation.
4. Finish: Comply with NEMA 250.
   a. Finish Color: Gray weather-resistant enamel.

B. Taps for Transformers 25 kVA and Larger Two 2.5 percent taps above and four 2.5 percent taps below normal full capacity.

C. Insulation Class, 30 kVA and Larger: 220 deg C, UL-component-recognized insulation system with a maximum of 115 deg C rise above 40 deg C ambient temperature.

D. Grounding: Provide ground-bar kit or a ground bar installed on the inside of the transformer enclosure.

E. Wall Brackets: Manufacturer's standard brackets.

2.4 IDENTIFICATION

A. Nameplates: Engraved, laminated-acrylic or melamine plastic signs for each distribution transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Section 260553 "Identification for Electrical Systems."

2.5 SOURCE QUALITY CONTROL

A. Test and inspect transformers according to IEEE C57.12.01 and IEEE C57.12.91.

1. Resistance measurements of all windings at rated voltage connections and at all tap connections.
2. Ratio tests at rated voltage connections and at all tap connections.
3. Phase relation and polarity tests at rated voltage connections.
4. No load losses, and excitation current and rated voltage at rated voltage connections.
5. Impedance and load losses at rated current and rated frequency at rated voltage connections.
6. Applied and induced tensile tests.
7. Regulation and efficiency at rated load and voltage.
8. Insulation-Resistance Tests:
   a. High-voltage to ground.
   b. Low-voltage to ground.
   c. High-voltage to low-voltage.
9. Temperature tests.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.

B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.

C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.

D. Verify that ground connections are in place and requirements in Section 260526 "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.

E. Environment: Enclosures shall be rated for the environment in which they are located.

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

3.2 INSTALLATION

A. Construct concrete bases according to Division 03 and anchor floor-mounted transformers according to manufacturer's written instructions**,** and requirements in Section 260529 "Hangers and Supports for Electrical Systems."

1. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

B. Secure transformer to concrete base according to manufacturer's written instructions.

C. Install wall-mounted transformers level and plumb with wall brackets fabricated by transformer manufacturer.

1. Coordinate installation of wall-mounted and structure-hanging supports with actual transformer provided.

D. Secure covers to enclosure and tighten all bolts to manufacturer-recommended torques to reduce noise generation.

E. Remove shipping bolts, blocking, and wedges.

3.3 CONNECTIONS

A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

D. Provide flexible connections at all conduit and conductor terminations and supports to eliminate sound and vibration transmission to the building structure.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Small (Up to 167-kVA Single-Phase or 500-kVA Three-Phase) Dry-Type Transformer Field Tests:

1. Visual and Mechanical Inspection.

a. Inspect physical and mechanical condition.

b. Inspect anchorage, alignment, and grounding.

c. Verify that resilient mounts are free and that any shipping brackets have been removed.

d. Verify the unit is clean.

e. Perform specific inspections and mechanical tests recommended by manufacturer.

f. Verify that as-left tap connections are as specified.

g. Verify the presence of surge arresters and that their ratings are as specified.

2. Electrical Tests:

a. Measure resistance at each winding, tap, and bolted connection.

b. Perform insulation-resistance tests winding-to-winding and each winding-to-ground. Apply voltage according to manufacturer's published data. In the absence of manufacturer's published data, comply with NETA ATS, Table 100.5. Calculate polarization index: the value of the index shall not be less than 1.0.

c. Perform turns-ratio tests at all tap positions. Test results shall not deviate by more than one-half percent from either the adjacent coils or the calculated ratio. If test fails, replace the transformer.

d. Verify correct secondary voltage, phase-to-phase and phase-to-neutral, after energization and prior to loading.

C. Remove and replace units that do not pass tests or inspections and retest as specified above.

D. Infrared Scanning: Two months after Substantial Completion, perform an infrared scan of transformer connections.

1. Use an infrared-scanning device designed to measure temperature or detect significant deviations from normal values. Provide documentation of device calibration.

2. Perform two follow-up infrared scans of transformers, one at four months and the other at 11 months after Substantial Completion.

3. Prepare a certified report identifying transformer checked and describing results of scanning. Include notation of deficiencies detected, remedial action taken, and scanning observations after remedial action.

E. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

3.5 ADJUSTING

A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 5 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.

B. Output Settings Report: Prepare a written report recording output voltages and tap settings.

3.6 CLEANING

A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION

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SECTION 262413
SWITCHBOARDS

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. Service and distribution switchboards rated 600 V and less.
2. Surge protection devices.
3. Disconnecting and overcurrent protective devices.
4. Instrumentation.
5. Control power.
6. Accessory components and features.
7. Identification.

B. Related Requirements

1. Section 260573.19 "Arc-Flash Hazard Analysis" for arc-flash analysis and arc-flash label requirements.

1.3 ACTION SUBMITTALS

A. Product Data: For each switchboard, overcurrent protective device, surge protection device, ground-fault protector, accessory, and component.

1. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

B. Shop Drawings: For each switchboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Detail short-circuit current rating of switchboards and overcurrent protective devices.
5. Include descriptive documentation of optional barriers specified for electrical insulation and isolation.
6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
7. Include time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.
8. Include schematic and wiring diagrams for power, signal, and control wiring.

C. Delegated Design Submittal:

1. For arc-flash hazard analysis.
2. For arc-flash labels.

1.4 INFORMATIONAL SUBMITTALS

A. Field Quality-Control Reports:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For switchboards and components to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Division 01, include the following:

a. Routine maintenance requirements for switchboards and all installed components.

b. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.

c. Time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver switchboards in sections or lengths that can be moved past obstructions in delivery path.

B. Remove loose packing and flammable materials from inside switchboards and install temporary electric heating (250 W per section) to prevent condensation.

C. Handle and prepare switchboards for installation according to NEMA PB 2.1.

1.7 FIELD CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install switchboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above switchboards is complete, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

a. Ambient Temperature: Not exceeding 104 deg F.

b. Altitude: Not exceeding 6600 feet.

B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Construction Manager no fewer than ten days in advance of proposed interruption of electric service.
2. Indicate method of providing temporary electric service.
3. Do not proceed with interruption of electric service without Construction Manager's written permission.
4. Comply with NFPA 70E.

1.8 COORDINATION

A. Coordinate layout and installation of switchboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.9 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace switchboard enclosures, buswork, overcurrent protective devices, accessories, and factory installed interconnection wiring that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Three years from date of Substantial Completion.

B. Manufacturer's Warranty: Manufacturer's agrees to repair or replace surge protection devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SWITCHBOARDS

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. Eaton.
2. Siemens Industry, Inc., Energy Management Division.
3. Square D; Schneider Electric USA.

B. Source Limitations: Obtain switchboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NEMA PB 2.

E. Comply with NFPA 70.

F. Comply with UL 891.

G. Front-Connected, Front-Accessible Switchboards:

1. Main Devices: Fixed, individually mounted.
2. Branch Devices: Panel mounted.
3. Sections front and rear aligned.

H. Indoor Enclosures: Steel, NEMA 250, Type 1.

I. Enclosure Finish for Indoor Units: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.

J. Outdoor Enclosures: Type 3R.

1. Finish: Factory-applied finish in manufacturer's standard color; undersurfaces treated with corrosion-resistant undercoating.
2. Enclosure: Hinged doors for each section, with provisions for padlocking.

K. Barriers: Between adjacent switchboard sections.

L. Space Heaters: Factory-installed electric space heaters of sufficient wattage in each vertical section to maintain enclosure temperature above expected dew point.

M. Service Entrance Rating: Switchboards intended for use as service entrance equipment shall contain from one to six service disconnecting means with overcurrent protection, a neutral bus with disconnecting link, a grounding electrode conductor terminal, and a main bonding jumper.

N. Customer Metering Compartment: A separate customer metering compartment for indicated metering, and current transformers for each meter.

O. Bus Transition and Incoming Pull Sections: Matched and aligned with basic switchboard.

P. Buses and Connections: Three phase, four wire unless otherwise indicated.

1. Provide phase bus arrangement A, B, C from front to back, top to bottom, and left to right when viewed from the front of the switchboard.
2. Phase- and Neutral-Bus Material: Hard-drawn copper of 98 percent conductivity, silver-plated.
3. Copper feeder circuit-breaker line connections.
4. Ground Bus: 1/4-by-2- hard-drawn copper of 98 percent conductivity, equipped with mechanical connectors for feeder and branch-circuit ground conductors.
5. Main-Phase Buses and Equipment-Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections. Provide for future extensions from both ends.
6. Neutral Buses: 100 percent of the ampacity of phase buses unless otherwise indicated, equipped with mechanical connectors for outgoing circuit neutral cables. Brace bus extensions for busway feeder neutral bus.

Q. Future Devices: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of circuit-breaker compartment.

2.2 SURGE PROTECTION DEVICES

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. Eaton.
2. Siemens Industry, Inc., Energy Management Division.
3. Square D; Schneider Electric USA.

B. SPDs: Comply with UL 1449.

C. Features and Accessories:

1. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
2. Indicator light display for protection status.
3. Surge counter.

D. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 250kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.

E. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V, three-phase, four-wire circuits shall not exceed the following:

1. Line to Neutral: 1200 V for 480Y/277 V.
2. Line to Ground: 1200 V for 480Y/277 V.
3. Line to Line: 2000 V for 480Y/277 V.

F. SCCR: Equal or exceed 100 kA.

G. Nominal Rating: 20 kA.

2.3 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:

   a. Instantaneous trip.

   b. Long- and short-time pickup levels.

   c. Long and short time adjustments.

   d. Ground-fault pickup level, time delay, and I squared t response.

2. MCCB Features and Accessories:

   a. Standard frame sizes, trip ratings, and number of poles.

   b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor material.

   c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.

2.4 INSTRUMENTATION

A. Multifunction Digital-Metering Monitor: Microprocessor-based unit suitable for three- or four-wire systems and with the following features:

1. Switch-selectable digital display of the following values with maximum accuracy tolerances as indicated:

   a. Phase Currents, Each Phase: Plus or minus 0.5 percent.

   b. Phase-to-Phase Voltages, Three Phase: Plus or minus 0.5 percent.

   c. Phase-to-Neutral Voltages, Three Phase: Plus or minus 0.5 percent.

   d. Megawatts: Plus or minus 1 percent.

   e. Megavars: Plus or minus 1 percent.

   f. Power Factor: Plus or minus 1 percent.

   g. Frequency: Plus or minus 0.1 percent.

   h. Accumulated Energy, Megawatt Hours: Plus or minus 1 percent; accumulated values unaffected by power outages up to 72 hours.

   i. Megawatt Demand: Plus or minus 1 percent; demand interval programmable from five to 60 minutes.

   j. Contact devices to operate remote impulse-totalizing demand meter.

2. Mounting: Display and control unit flush or semiflush mounted in instrument compartment door.

2.5 IDENTIFICATION

A. Service Equipment Label: NRTL labeled for use as service equipment for switchboards with one or more service disconnecting and overcurrent protective devices.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store switchboards according to NEMA PB 2.1.

1. Lift or move panelboards with spreader bars and manufacturer-supplied lifting straps following manufacturer's instructions.
2. Use rollers, slings, or other manufacturer-approved methods if lifting straps are not furnished.
3. Protect from moisture, dust, dirt, and debris during storage and installation.
4. Install temporary heating during storage per manufacturer's instructions.

B. Examine switchboards before installation. Reject switchboards that are moisture damaged or physically damaged.

C. Examine elements and surfaces to receive switchboards for compliance with installation tolerances and other conditions affecting performance of the Work or that affect the performance of the equipment.

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

3.2 INSTALLATION

A. Install switchboards and accessories according to NEMA PB 2.1.

B. Equipment Mounting: Install switchboards on concrete base, 4-inch nominal thickness. Comply with requirements for concrete base specified in Division 03.

1. Install conduits entering underneath the switchboard, entering under the vertical section where the conductors will terminate. Install with couplings flush with the concrete base. Extend 2 inches above concrete base after switchboard is anchored in place.
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 concrete base.
3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to switchboards.
6. Anchor switchboard to building structure at the top of the switchboard if required or recommended by the manufacturer.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, straps and brackets, and temporary blocking of moving parts from switchboard units and components.

D. Install filler plates in unused spaces of panel-mounted sections.

E. Install overcurrent protective devices, surge protection devices, and instrumentation.

1. Set field-adjustable circuit-breaker trip ranges.

F. Comply with NECA 1.

3.3 CONNECTIONS

A. Bond conduits entering underneath the switchboard to the equipment ground bus with a bonding conductor sized per NFPA 70.

B. Support and secure conductors within the switchboard according to NFPA 70.

C. Extend insulated equipment grounding cable to busway ground connection and support cable at intervals in vertical run.

3.4 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. Switchboard Nameplates: Label each switchboard compartment with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

C. Device Nameplates: Label each disconnecting and overcurrent protective device and each meter and control device mounted in compartment doors with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections with the assistance of a factory-authorized service representative.

B. Tests and Inspections:

1. Acceptance Testing:

   a. Test insulation resistance for each switchboard bus, component, connecting supply, feeder, and control circuit. Open control and metering circuits within the switchboard, and remove neutral connection to surge protection and other electronic devices prior to insulation test. Reconnect after test.

   b. Test continuity of each circuit.

2. Test ground-fault protection of equipment for service equipment per NFPA 70.

3. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

4. Correct malfunctioning units on-site where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

5. Perform the following infrared scan tests and inspections, and prepare reports:

   a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switchboard. Remove front panels so joints and connections are accessible to portable scanner.

   b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switchboard 11 months after date of Substantial Completion.

   c. Instruments and Equipment:

      1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

6. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

C. Switchboard will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports, including a certified report that identifies switchboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as indicated.

3.7 PROTECTION

A. Temporary Heating: Apply temporary heat, to maintain temperature according to manufacturer's written instructions, until switchboard is ready to be energized and placed into service.

END OF SECTION

SECTION 262416
PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS

A. ATS: Acceptance testing specification.

B. GFCI: Ground-fault circuit interrupter.

C. GFEP: Ground-fault equipment protection.

D. HID: High-intensity discharge.

E. MCCB: Molded-case circuit breaker.

F. VPR: Voltage protection rating.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of panelboard.

1. Include materials, switching and overcurrent protective devices, SPDs, accessories, and components indicated.
2. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details.
2. Show tabulations of installed devices with nameplates, conductor termination sizes, equipment features, and ratings.
3. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
4. Detail bus configuration, current, and voltage ratings.
5. Short-circuit current rating of panelboards and overcurrent protective devices.
6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
7. Include wiring diagrams for power, signal, and control wiring.
8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device. Include an Internet link for electronic access to downloadable PDF of the coordination curves.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01, include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

B. Handle and prepare panelboards for installation according to NEMA PB 1.

1.7 FIELD CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
   a. Ambient Temperature: Not exceeding 23 deg F to plus 104 deg F.
   b. Altitude: Not exceeding 6600 feet.

B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Construction Manager no fewer than ten days in advance of proposed interruption of electric service.
2. Do not proceed with interruption of electric service without Construction Manager's written permission.
3. Comply with NFPA 70E.

1.8 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.

1. Panelboard Warranty Period: 18 months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANELBOARDS COMMON REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NEMA PB 1.

C. Comply with NFPA 70.

D. Enclosures: Flush and surface-mounted, dead-front cabinets.

1. Rated for environmental conditions at installed location.
   a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
   b. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12

2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box. Trims shall cover all live parts and shall have no exposed hardware.
3. Finishes:
    a. Panels and Trim: Steel and galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
    b. Back Boxes: Galvanized steel.

E. Phase, Neutral, and Ground Buses:
1. Material: Hard-drawn copper, 98 percent conductivity.
    a. Plating shall run entire length of bus.
    b. Bus shall be fully rated the entire length.
2. Interiors shall be factory assembled into a unit. Replacing switching and protective devices shall not disturb adjacent units or require removing the main bus connectors.
3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
4. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure. Do not mount neutral bus in gutter.

F. Conductor Connectors: Suitable for use with conductor material and sizes.
1. Material: Hard-drawn copper, 98 percent conductivity.
2. Terminations shall allow use of 75 deg C rated conductors without derating.
3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.
4. Main and Neutral Lugs: Mechanical type, with a lug on the neutral bar for each pole in the panelboard.
5. Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panelboard.
6. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
7. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.

G. Future Devices: Panelboards shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

H. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.
1. Panelboards and overcurrent protective devices rated 240 V or less shall have short-circuit ratings as shown on Drawings, but not less than 10,000 A rms symmetrical.
2. Panelboards and overcurrent protective devices rated above 240 V and less than 600 V shall have short-circuit ratings as shown on Drawings, but not less than 14,000 A rms symmetrical.

2.2 POWER PANELBOARDS

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. Eaton.
2. Siemens Industry, Inc., Energy Management Division.
3. Square D; Schneider Electric USA.

B. Panelboards: NEMA PB 1, distribution type.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than 36 inches high, provide two latches, keyed alike.

D. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers or plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

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. Eaton.

2. Siemens Industry, Inc., Energy Management Division.

3. Square D; Schneider Electric USA.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

D. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Eaton.

2. Siemens Industry, Inc., Energy Management Division.

3. Square D; Schneider Electric USA.

B. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers:

a. Inverse time-current element for low-level overloads.

b. Instantaneous magnetic trip element for short circuits.

c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

2. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).

3. GFEP Circuit Breakers: Class B ground-fault protection (30-mA trip).

4. Subfeed Circuit Breakers: Vertically mounted.

5. MCCB Features and Accessories:

a. Standard frame sizes, trip ratings, and number of poles.

b. Breaker handle indicates tripped status.

c. UL listed for reverse connection without restrictive line or load ratings.

d. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.

e. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and HID lighting circuits.

f. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.

g. Multipole units enclosed in a single housing with a single handle.

h. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.

i. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

2.5 IDENTIFICATION

A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.

B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.

C. Circuit Directory: Directory card inside panelboard door, mounted in transparent card holder.

1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.

B. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.

C. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.

D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

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

3.2 INSTALLATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Comply with NECA 1.

C. Install panelboards and accessories according to NEMA PB 1.1.

D. Equipment Mounting:

1. Attach panelboard to the vertical finished or structural surface behind the panelboard.

E. Mount panelboard cabinet plumb and rigid without distortion of box.

F. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

G. Mount surface-mounted panelboards to steel slotted supports 5/8 inch in depth. Orient steel slotted supports vertically.

H. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

2. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written instructions.

I. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.

J. Install filler plates in unused spaces.

K. Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.

L. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in power panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

E. Install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems" identifying source of remote circuit.

3.4 FIELD QUALITY CONTROL

A. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.

2. Test continuity of each circuit.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers stated in NETA ATS, Paragraph 7.6 Circuit Breakers. Do not perform optional tests. Certify compliance with test parameters.

2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3. Perform the following infrared scan tests and inspections and prepare reports:

a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.

b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.

c. Instruments and Equipment:

1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

C. Panelboards will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results, with comparisons of the two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes. Prior to making circuit changes to achieve load balancing, inform Architect of effect on phase color coding.

1. Measure loads during period of normal facility operations.

2. Perform circuit changes to achieve load balancing outside normal facility operation schedule or at times directed by the Architect. Avoid disrupting services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After changing circuits to achieve load balancing, recheck loads during normal facility operations. Record load readings before and after changing circuits to achieve load balancing.
4. Tolerance: Maximum difference between phase loads, within a panelboard, shall not exceed 20 percent.

3.6 PROTECTION

A. Temporary Heating: Prior to energizing panelboards, apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION

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SECTION 262726
WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Standard-grade receptacles, 125 V, 20 A.
2. GFCI receptacles, 125 V, 20 A.
3. Toggle switches, 120/277 V, 20 A.
4. Wall plates.

1.3 DEFINITIONS

A. GFCI: Ground-fault circuit interrupter.

B. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

PART 2 - PRODUCTS

2.1 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. Comply with NFPA 70.

C. RoHS compliant.

D. Comply with NEMA WD 1.

E. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:

1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
2. Devices shall comply with requirements in this Section.

F. Device Color:

1. Wiring Devices Connected to Normal Power System: As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.

G. Wall Plate Color: For plastic covers, match device color.

H. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 STANDARD-GRADE RECEPTACLES, 125 V, 20 A

A. Duplex Receptacles, 125 V, 20 A:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated; HBL 5362 or a comparable product by one of the following:
   a. Arrow Hart, Wiring Devices; Eaton, Electrical Sector.
   b. Leviton Manufacturing Co., Inc.
   c. Pass & Seymour; Legrand North America, LLC.
2. Description: Two pole, three wire, and self-grounding.
3. Configuration: NEMA WD 6, Configuration 5-20R.
4. Standards: Comply with UL 498 and FS W-C-596.

2.3 GFCI RECEPTACLES, 125 V, 20 A

A. Duplex GFCI Receptacles, 125 V, 20 A:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated; GFRST20 or a comparable product by one of the following:
   a. Arrow Hart, Wiring Devices; Eaton, Electrical Sector.
   b. Leviton Manufacturing Co., Inc.
   c. Pass & Seymour; Legrand North America, LLC.
2. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding.
3. Configuration: NEMA WD 6, Configuration 5-20R.
4. Type: Non-feed through.
5. Standards: Comply with UL 498, UL 943 Class A, and FS W-C-596.

2.4 TOGGLE SWITCHES, 120/277 V, 20 A

A. Single-Pole Switches, 120/277 V, 20 A:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated ; HBL1221. or a comparable product by one of the following:
   a. Arrow Hart, Wiring Devices; Eaton, Electrical Sector.
   b. Leviton Manufacturing Co., Inc.
   c. Pass & Seymour; Legrand North America, LLC.
2. Standards: Comply with UL 20 and FS W-S-896.

B. Three-Way Switches, 120/277 V, 20 A:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated ; HBL1223. or a comparable product by one of the following:
   a. Arrow Hart, Wiring Devices; Eaton, Electrical Sector.
   b. Leviton Manufacturing Co., Inc.
   c. Pass & Seymour; Legrand North America, LLC.
2. Comply with UL 20 and FS W-S-896.

C. Four-Way Switches, 120/277 V, 20 A:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Hubbell Wiring Device-Kellems; brand of Hubbell Electrical Solutions; Hubbell Incorporated ; HBL1224. or a comparable product by one of the following:

a. Arrow Hart, Wiring Devices; Eaton, Electrical Sector.

b. Leviton Manufacturing Co., Inc.

c. Pass & Seymour; Legrand North America, LLC.

2. Standards: Comply with UL 20 and FS W-S-896.

2.5 WALL PLATES

A. Single Source: Obtain wall plates from same manufacturer of wiring devices.

B. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.

2. Material for Finished Spaces: Smooth, high-impact thermoplastic.

3. Material for Unfinished Spaces: Galvanized steel.

C. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

PART 3 - EXECUTION

3.1 **INSTALLATION**

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes, and do not cut holes for boxes with routers that are guided by riding against outside of boxes.

2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.

3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.

4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.

2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.

3. The length of free conductors at outlets for devices shall comply with NFPA 70, Article 300, without pigtails.

4. Existing Conductors:

a. Cut back and pigtail, or replace all damaged conductors.

b. Straighten conductors that remain and remove corrosion and foreign matter.

c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.

2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted **receptacles down, and on horizontally mounted receptacles to the right.**

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on bottom. Group adjacent switches under single, multigang wall plates.

3.2 IDENTIFICATION

A. Comply with Section 260553 "Identification for Electrical Systems."

B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.3 FIELD QUALITY CONTROL

A. Test Instruments: Use instruments that comply with UL 1436.

B. Test Instrument for Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

C. Perform the following tests and inspections:

1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

D. Tests for Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault-current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

E. Wiring device will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

END OF SECTION

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SECTION 262813
FUSES

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. Cartridge fuses rated 600 V ac and less for use in the following:

a. Enclosed switches.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include construction details, material descriptions, dimensions of individual components and profiles. Include the following for each fuse type indicated:

1. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
2. Current-limitation curves for fuses with current-limiting characteristics.
3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.
4. Coordination charts and tables and related data.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01, include the following:

1. Ambient temperature adjustment information.
2. Current-limitation curves for fuses with current-limiting characteristics.
3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse used on the Project.
4. Coordination charts and tables and related data.

1.5 FIELD CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F or more than 100 deg F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Bussmann; Eaton, Electrical Sector.
2. Littelfuse, Inc.
3. Mersen USA.

B. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, current-limiting, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

1. Type RK-1: 250 or 600-V, zero- to 600-A rating, 200 kAIC, time delay.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA FU 1 for cartridge fuses.

D. Comply with NFPA 70.

E. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.

B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.

C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

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

3.2 FUSE APPLICATIONS

A. Cartridge Fuses:

1. Motor Branch Circuits: Class RK5, time delay.

3.3 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

3.4 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems" and indicating fuse replacement information inside of door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION

SECTION 262816
ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Nonfusible switches.
3. Molded-case circuit breakers (MCCBs).
4. Molded-case switches.
5. Enclosures.

1.3 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include nameplate ratings, dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).
4. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
5. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

B. Shop Drawings: For enclosed switches and circuit breakers.

1. Include plans, elevations, sections, details, and attachments to other work.
2. Include wiring diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Division 01, include the following:

a. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.

b. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
2. Altitude: Not exceeding 6600 feet.

1.8 WARRANTY

A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

C. Comply with NFPA 70.

2.2 FUSIBLE SWITCHES

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. ABB, Electrification Business.
2. Eaton.
3. Siemens Industry, Inc., Energy Management Division.
4. Square D; Schneider Electric USA.

B. Type HD, Heavy Duty:

1. Single throw.
2. Three pole.
3. 240 or 600-V ac.
4. 1200 A and smaller.
5. UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified uses.
6. Lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
4. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.3 NONFUSIBLE SWITCHES

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. ABB, Electrification Business.

2. Eaton.
3. Siemens Industry, Inc., Energy Management Division.
4. Square D; Schneider Electric USA.

B. Type HD, Heavy Duty, Three Pole, Single Throw, 240 or 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:
1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.4 MOLDED-CASE CIRCUIT BREAKERS

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. ABB, Electrification Business.
2. Eaton.
3. Siemens Industry, Inc., Energy Management Division.
4. Square D; Schneider Electric USA.

B. Circuit breakers shall be constructed using glass-reinforced insulating material. Current carrying components shall be completely isolated from the handle and the accessory mounting area.

C. Circuit breakers shall have a toggle operating mechanism with common tripping of all poles, which provides quick-make, quick-break contact action. The circuit-breaker handle shall be over center, be trip free, and reside in a tripped position between on and off to provide local trip indication. Circuit-breaker escutcheon shall be clearly marked on and off in addition to providing international I/O markings. Equip circuit breaker with a push-to-trip button, located on the face of the circuit breaker to mechanically operate the circuit-breaker tripping mechanism for maintenance and testing purposes.

D. The maximum ampere rating and UL, IEC, or other certification standards with applicable voltage systems and corresponding interrupting ratings shall be clearly marked on face of circuit breaker. Circuit breakers shall be 100 percent rated.

E. MCCBs shall be equipped with a device for locking in the isolated position.

F. Standard: Comply with UL 489 with interrupting capacity to comply with available fault currents.

G. Thermal-Magnetic Circuit Breakers: Inverse time-current thermal element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

H. Ground-Fault Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).

I. Ground-Fault Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).

J. Features and Accessories:
1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.

4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.

2.5 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: UL 489, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

B. Enclosure Finish: The enclosure shall be gray baked enamel paint, electrodeposited on cleaned, phosphatized steel (NEMA 250 Type 1 or gray baked enamel paint, electrodeposited on cleaned, phosphatized galvannealed steel (NEMA 250 Type 3R.

C. Operating Mechanism: The circuit-breaker operating handle shall be directly operable through the front cover of the enclosure (NEMA 250 Type 1). The cover interlock mechanism shall have an externally operated override. The override shall not permanently disable the interlock mechanism, which shall return to the locked position once the override is released. The tool used to override the cover interlock mechanism shall not be required to enter the enclosure in order to override the interlock.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

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

1. Commencement of work shall indicate Installer's acceptance of the areas and conditions as satisfactory.

3.2 PREPARATION

A. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Construction Manager no fewer than ten days in advance of proposed interruption of electric service.
2. Indicate method of providing temporary electric service.
3. Do not proceed with interruption of electric service without Construction Manager's written permission.
4. Comply with NFPA 70E.

3.3 ENCLOSURE ENVIRONMENTAL RATING APPLICATIONS

A. Enclosed Switches and Circuit Breakers: Provide enclosures at installed locations with the following environmental ratings.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 3R.

3.4 INSTALLATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

C. Install fuses in fusible devices.

D. Comply with NFPA 70 and NECA 1.

3.5 IDENTIFICATION

A. Comply with requirements in Section 260553 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections for Switches:

1. Visual and Mechanical Inspection:
   a. Inspect physical and mechanical condition.
   b. Inspect anchorage, alignment, grounding, and clearances.
   c. Verify that the unit is clean.
   d. Verify blade alignment, blade penetration, travel stops, and mechanical operation.
   e. Verify that fuse sizes and types match the Specifications and Drawings.
   f. Verify that each fuse has adequate mechanical support and contact integrity.
   g. Inspect bolted electrical connections for high resistance using one of the two following methods:
      1) Use a low-resistance ohmmeter.
         a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
      2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.
         a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
   h. Verify that operation and sequencing of interlocking systems is as described in the Specifications and shown on the Drawings.
   i. Verify correct phase barrier installation.
   j. Verify lubrication of moving current-carrying parts and moving and sliding surfaces.

C. Tests and Inspections for Molded Case Circuit Breakers:

1. Visual and Mechanical Inspection:
   a. Verify that equipment nameplate data are as described in the Specifications and shown on the Drawings.
   b. Inspect physical and mechanical condition.
   c. Inspect anchorage, alignment, grounding, and clearances.
   d. Verify that the unit is clean.
   e. Operate the circuit breaker to ensure smooth operation.

f. Inspect bolted electrical connections for high resistance using one of the two following methods:

1) Use a low-resistance ohmmeter.

a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.

2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.

a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.

g. Inspect operating mechanism, contacts, and chutes in unsealed units.

h. Perform adjustments for final protective device settings in accordance with the coordination study.

D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

1. Test procedures used.

2. Include identification of each enclosed switch and circuit breaker tested and describe test results.

3. List deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION

SECTION 262913.03
MANUAL MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Manual motor controllers.
2. Enclosures.

1.3 DEFINITIONS

A. NC: Normally closed.

B. OCPD: Overcurrent protective device.

C. SCCR: Short-circuit current rating.

D. SCPD: Short-circuit protective device.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For magnetic controllers to include in operation and maintenance manuals.

1. In addition to items specified in Division 01, include the following:

a. Routine maintenance requirements for magnetic controllers and installed components.

b. Load-Current and Overload-Relay Heater List: Compile after motors have been installed, and arrange to demonstrate that selection of heaters suits actual motor nameplate full-load currents.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store controllers indoors in clean, dry space with uniform temperature to prevent condensation. Protect controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage.

1.8 FIELD CONDITIONS

A. Ambient Environment Ratings: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than23 deg F and not exceeding 104 deg F.
2. Altitude: Not exceeding 6600 feet for electromagnetic and manual devices.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. UL Compliance: Fabricate and label magnetic motor controllers to comply with UL 508 and UL 60947-4-1.

C. NEMA Compliance: Fabricate motor controllers to comply with ICS 2.

2.2 MANUAL MOTOR CONTROLLERS

A. Fractional Horsepower Manual Controllers (FHPMC): "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off, on, or tripped.

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. ABB, Electrification Business.

b. Eaton.

c. Siemens Industry, Inc., Energy Management Division.

d. Square D; Schneider Electric USA.

2. Configuration: Nonreversing.

3. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 10 tripping characteristics; heaters matched to nameplate full-load current of actual protected motor; external reset push button; bimetallic type or melting alloy type.

4. Overload Relays: NEMA ICS 2, bimetallic class as schedule on Drawings.

5. Pilot Light: Red.

2.3 ENCLOSURES

A. Comply with NEMA 250, type designations as indicated on Drawings, complying with environmental conditions at installed location.

B. The construction of the enclosures shall comply with NEMA ICS 6.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and space conditions for compliance with requirements for motor controllers, their relationship with the motors, and other conditions affecting performance of the Work.

3.2 INSTALLATION

A. Comply with NECA 1.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Comply with the provisions of NFPA 70B, "Testing and Test Methods" Chapter.

2. Visual and Mechanical Inspection:

a. Compare equipment nameplate data with drawings and specifications.

b. Inspect physical and mechanical condition.

c. Inspect anchorage, alignment, and grounding.

d. Verify the unit is clean.

e. Inspect contactors:

1) Verify mechanical operation.

f. Motor-Running Protection:

1) Verify overload element rating is correct for its application.

C. Motor controller will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION

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SECTION 264113

LIGHTNING PROTECTION FOR STRUCTURES

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 lightning protection system for ordinary structures.

B. Section includes lightning protection system for the following:

1. Ordinary structures.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Include layouts of the lightning protection system, with details of the components to be used in the installation.
2. Include raceway locations needed for the installation of conductors.
3. Details of air terminals, ground rods, ground rings, conductor supports, splices, and terminations, including concealment requirements.
4. Include roof attachment details, coordinated with roof installation.
5. Calculations required by NFPA 780 for bonding of metal bodies.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Lightning protection system Shop Drawings, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Lightning protection cabling attachments to roofing systems and accessories.
2. Lightning protection strike termination device attachment to roofing systems, coordinated with the roofing system manufacturer.
3. Lightning protection system components penetrating roofing and moisture protection systems and system components, coordinated with the roofing system manufacturer.

B. Qualification Data: For Installer.

C. Product Certificates: For each type of roof adhesive for attaching the roof-mounted air terminal assemblies, approved by the roofing-material manufacturer.

D. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For lightning protection system to include in maintenance manuals.

1. In addition to items specified in Division 01, include the following:
   a. Dimensioned site plan showing dimensioned route of the ground loop conductor and the ground rod locations. Comply with requirements of Section 017839 "Project Record Documents."
   b. A system testing and inspection record, listing the results of inspections and ground resistance tests, as recommended by NFPA 780, Annex D.

B. Completion Certificate:

1. UL Master Label Certificate.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: UL-listed installer, category OWAY or LPI Master Installer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. East Coast Lightning Equipment Inc.
2. Harger Lightning & Grounding; business of Harger, Inc.
3. Heary Bros. Lightning Protection Co. Inc

2.2 PERFORMANCE REQUIREMENTS

A. NFPA Lightning Protection Standard: Comply with NFPA 780 requirements.

B. UL Lightning Protection Standard: Comply with UL 96A requirements.

C. Lightning Protection Components, Devices, and Accessories: Listed and labeled by a qualified testing agency as complying with UL 96, and marked for intended location and application.

D. Lightning protection system for the addition shall be compatible with existing lightning protection and shall be interconnected to existing system.

2.3 MATERIALS

A. All proposed materials shall match those currently installed for the existing lightning protection system.:

B. Conductor Splices and Connectors: Compression fittings that are installed with hydraulically operated tools, or exothermic welds, approved for use with the class type.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install lightning protection components and systems according to UL 96A and NFPA 780.

B. Install conductors with direct paths from air terminals to ground connections. Avoid bends less than 90 degrees and 8 inches in radius and narrow loops.

C. Conceal conductors within normal view from exterior locations at grade within 200 feet of building.

1. Roof penetrations required for down conductors and connections to structural-steel framework shall be made using listed through-roof fitting and connector assemblies with solid rods and appropriate roof flashings. Use materials approved by the roofing manufacturer for the purpose. Conform to the methods and materials required at roofing penetrations of the lightning protection components to ensure compatibility with the roofing specifications and warranty.
2. Install conduit where necessary to comply with conductor concealment requirements.
3. Air Terminals on Single-Ply Membrane Roofing: Comply with adhesive manufacturer's written instructions.

D. Ground Ring Electrode: The conductor shall be not less than the main-size lightning conductor.

3.2 CONNECTIONS

A. Aboveground concealed connections, and connections in earth or concrete, shall be done by exothermic welds or by high-compression fittings listed for the purpose.

B. Aboveground exposed connections shall be done using the following types of connectors, listed and labeled for the purpose: bolted connectors, exothermic weld, high compression crimp.

C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.

2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.

3.3 CORROSION PROTECTION

A. Do not combine materials that can form an electrolytic couple that will accelerate corrosion in the presence of moisture unless moisture is permanently excluded from junction of such materials.

B. Use conductors with protective coatings where conditions would cause deterioration or corrosion of conductors.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:

1. Perform inspections as required to obtain a UL Master Label for system.

B. Prepare test and inspection reports and certificates.

END OF SECTION

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SECTION 265119
LED INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Luminaires.
2. Luminaire support.

B. Related Requirements:

1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including photoelectric relays, occupancy sensors, and daylight sensors.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. LED: Light-emitting diode.

F. Lumen: Measured output of lamp and luminaire, or both.

G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Arrange in order of luminaire designation.
2. Include data on features, accessories, and finishes.
3. Include physical description and dimensions of luminaires.
4. Include emergency lighting units, including batteries and chargers.
5. Include life, output (lumens, CCT, and CRI), and energy-efficiency data.
6. Photometric data and adjustment factors based on laboratory tests.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Provide luminaires from a single manufacturer for each luminaire type.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.8 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

B. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

C. Recessed luminaires shall comply with NEMA LE 4.

2.2 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product.

2.3 LUMINAIRE SUPPORT

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

B. Wires: ASTM A641/A641M, Class 3, soft temper, zinc-coated steel, 12 gage.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.

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

3.2 TEMPORARY LIGHTING

A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting.

3.3 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Supports:

1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning.
3. Provide support for luminaire without causing deflection of ceiling or wall.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

D. Flush-Mounted Luminaires:

1. Secured to outlet box.
2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
3. Trim ring flush with finished surface.

E. Wall-Mounted Luminaires:

1. Do not attach luminaires directly to gypsum board.

F. Ceiling-Grid-Mounted Luminaires:

1. Secure to any required outlet box.

2. Secure luminaire to the luminaire opening using approved fasteners in a minimum of four locations, spaced near corners of luminaire.
3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

G. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION

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SECTION 265213
EMERGENCY AND EXIT LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Emergency lighting.
2. Exit signs.
3. Luminaire support components.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Fixture: See "Luminaire" Paragraph.

D. Lumen: Measured output of lamp and luminaire, or both.

E. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of emergency lighting unit, exit sign, and emergency lighting support.

1. Include data on features, accessories, and finishes.
2. Include physical description of the unit and dimensions.
3. Include life, output of luminaire (lumens, CCT, and CRI), and energy-efficiency data.
4. Include photometric data for each luminaire type.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in emergency, operation, and maintenance manuals.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.7 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR EMERGENCY LIGHTING

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NRTL Compliance: Fabricate and label exit signs, and batteries to comply with UL 924.

C. Comply with NFPA 70 and NFPA 101.

D. Internal Type Emergency Power Unit: Self-contained, battery pack, factory mounted within luminaire body.

2.2 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product

2.3 LUMINAIRE SUPPORT COMPONENTS

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

B. Support Wires: ASTM A641/A641M, Class 3, soft temper, zinc-coated steel, 12 gage.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for conditions affecting performance of luminaires.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.

C. Examine walls, floors, roofs, and ceilings for suitable conditions where emergency lighting luminaires will be installed.

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

3.2 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Supports:

1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position when testing emergency power unit.
3. Provide support for luminaire without causing deflection of ceiling or wall.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire and emergency power unit weight and vertical force of 400 percent of luminaire weight.

D. Wall-Mounted Luminaire Support:

1. Do not attach luminaires directly to gypsum board.

E. Ceiling Grid Mounted Luminaires:

1. Secure to any required outlet box.
2. Secure emergency power unit using approved fasteners in a minimum of four locations, spaced near corners of emergency power unit.
3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION

SECTION 265619
LED EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Luminaires.
2. Luminaire support components.

B. Related Requirements:

1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color rendering index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. Lumen: Measured output of lamp and luminaire, or both.

F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of luminaire.

1. Arrange in order of luminaire designation.
2. Include data on features, accessories, and finishes.
3. Include physical description and dimensions of luminaire.
4. Lamps, include life, output (lumens, CCT, and CRI), and energy-efficiency data.
5. Photometric data.
6. Wiring diagrams for power, control, and signal wiring.
7. Means of attaching luminaires to supports and indication that the attachment is suitable for components involved.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires to include in operation and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Provide luminaires from a single manufacturer for each luminaire type.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering prior to shipping.

1.8 FIELD CONDITIONS

A. Verify existing and proposed utility structures prior to the start of work associated with luminaire installation.

B. Mark locations of exterior luminaires for approval by Architect prior to the start of luminaire installation.

1.9 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures, including luminaire support components.

b. Faulty operation of luminaires and accessories.

c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Period: 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. UL Compliance: Comply with UL 1598.

C. Source Limitations: Obtain luminaires from single source from a single manufacturer

1. .

2.2 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product.

2.3 LUMINAIRE SUPPORT COMPONENTS

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for luminaire electrical conduit to verify actual locations of conduit connections before luminaire installation.

C. Examine walls, roofs, canopy ceilings and overhang ceilings for suitable conditions where luminaires will be installed.

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

3.2 TEMPORARY LIGHTING

A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is substantially complete, clean luminaires used for temporary lighting and install new lamps.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Comply with NECA 1.

B. Use fastening methods and materials selected to approved by manufacturer.

C. Wiring Method: Install cables in raceways. Conceal raceways and cables.

D. Install luminaires level, plumb, and square with finished grade unless otherwise indicated. Install luminaires at height as indicated on Drawings.

E. Coordinate layout and installation of luminaires with other construction.

3.4 FIELD QUALITY CONTROL

A. Inspect each installed luminaire for damage. Replace damaged luminaires and components.

B. Perform the following tests and inspections:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.

C. Luminaire will be considered defective if it does not pass tests and inspections.

END OF SECTION

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SECTION 270526

GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Grounding conductors.
2. Grounding connectors.
3. Grounding busbars.
4. Grounding labeling.

1.3 DEFINITIONS

A. BCT: Bonding conductor for telecommunications.

B. TGB: Telecommunications grounding busbar.

C. TMGB: Telecommunications main grounding busbar.

D. Service Provider: The operator of a service that provides telecommunications transmission delivered over access provider facilities.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.5 INFORMATIONAL SUBMITTALS

A. As-Built Data: Plans showing as-built locations of grounding and bonding infrastructure, including the following:

1. Ground rods.
2. Ground and roof rings.
3. BCT, TMGB, TGBs, and routing of their bonding conductors.

B. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Division 01, include the following:

a. Result of the ground-resistance test, measured at the point of BCT connection.

b. Result of the bonding-resistance test at each TGB and its nearest grounding electrode.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

C. Comply with TIA-607-B.

2.2 CONDUCTORS

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. Harger Lightning & Grounding; business of Harger, Inc.
2. Panduit Corp.
3. TE Connectivity Ltd.

B. Comply with UL 486A-486B.

C. Insulated Conductors: Stranded copper wire, green or green with yellow stripe insulation, insulated for 600 V, and complying with UL 83.

1. Ground wire for custom-length equipment ground jumpers shall be No. 6 AWG, 19-strand, UL-listed, Type THHN wire.

D. Bare Copper Conductors:

1. Solid Conductors: ASTM B3.
2. Stranded Conductors: ASTM B8.
3. Tinned Conductors: ASTM B33.
4. Bonding Cable: 28 kcmils, 14 strands of No. 17 AWG conductor, and 1/4 inch in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Tinned-copper tape, braided conductors terminated with two-hole copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

2.3 CONNECTORS

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. Burndy; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
2. Harger Lightning & Grounding; business of Harger, Inc.
3. TE Connectivity Ltd.

B. Irreversible connectors listed for the purpose. Listed by an NRTL as complying with NFPA 70 for specific types, sizes, and combinations of conductors and other items connected. Comply with UL 486A-486B.

C. Compression Wire Connectors: Crimp-and-compress connectors that bond to the conductor when the connector is compressed around the conductor. Comply with UL 467.

1. Electroplated tinned copper, C and H shaped.

D. Signal Reference Grid Connectors: Combination of compression wire connectors, access floor grounding clamps, bronze U-bolt grounding clamps, and copper split-bolt connectors, designed for the purpose.

E. Busbar Connectors: Cast silicon bronze, solderless compression or exothermic-type, mechanical connector; with a long barrel and two holes spaced on 5/8- or 1-inch centers for a two-bolt connection to the busbar.

F. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.4 GROUNDING BUSBARS

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. Chatsworth Products, Inc.
2. Harger Lightning & Grounding; business of Harger, Inc.
3. Panduit Corp.

B. TMGB: Predrilled, wall-mounted, rectangular bars of hard-drawn solid copper, 1/4 by 4 inches in cross section, length as indicated on Drawings. The busbar shall be NRTL listed for use as TMGB and shall comply with TIA-607-B.

1. Predrilling shall be with holes for use with lugs specified in this Section.
2. Mounting Hardware: Stand-off brackets that provide a 4-inch clearance to access the rear of the busbar. Brackets and bolts shall be stainless steel.
3. Stand-off insulators for mounting shall be Lexan or PVC. Comply with UL 891 for use in 600-V switchboards, impulse tested at 5000 V.

C. TGB: Predrilled rectangular bars of hard-drawn solid copper, 1/4 by 2 inches in cross section, length as indicated on Drawings. The busbar shall be for wall mounting, shall be NRTL listed as complying with UL 467, and shall comply with TIA-607-B.

1. Predrilling shall be with holes for use with lugs specified in this Section.
2. Mounting Hardware: Stand-off brackets that provide at least a 2-inch clearance to access the rear of the busbar. Brackets and bolts shall be stainless steel.
3. Stand-off insulators for mounting shall be Lexan or PVC. Comply with UL 891 for use in 600-V switchboards, impulse tested at 5000 V.

2.5 IDENTIFICATION

A. Comply with requirements for identification products in Section 260553 "Identification for Electrical Systems."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the ac grounding electrode system and equipment grounding for compliance with requirements for maximum ground-resistance level and other conditions affecting performance of grounding and bonding of the electrical system.

B. Inspect the test results of the ac grounding system measured at the point of BCT connection.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with connection of the BCT only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Bonding shall include the ac utility power service entrance, the communications cable entrance, and the grounding electrode system. The bonding of these elements shall form a loop so that each element is connected to at least two others.

B. Comply with NECA 1.

C. Comply with TIA-607-B.

3.3 APPLICATION

A. Conductors: Install solid conductor for No. 8 AWG and smaller and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

1. The bonding conductors between the TGB and structural steel of steel-frame buildings shall not be smaller than No. 6 AWG.
2. The bonding conductors between the TMGB and structural steel of steel-frame buildings shall not be smaller than No. 6 AWG.

B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2 AWG minimum.

C. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors.

3. Connections to Structural Steel: Welded connectors.

D. Conductor Support:

1. Secure grounding and bonding conductors at intervals of not less than 36 inches.

E. Grounding and Bonding Conductors:

1. Install in the straightest and shortest route between the origination and termination point, and no longer than required. The bend radius shall not be smaller than eight times the diameter of the conductor. No one bend may exceed 90 degrees.

2. Install without splices.

3. Support at not more than 36-inch intervals.

4. Install grounding and bonding conductors in 3/4-inch PVC conduit until conduit enters a telecommunications room. The grounding and bonding conductor pathway through a plenum shall be in EMT. Conductors shall not be installed in EMT unless otherwise indicated.

a. If a grounding and bonding conductor is installed in ferrous metallic conduit, bond the conductor to the conduit using a grounding bushing and bond both ends of the conduit to a TGB.

3.4 GROUNDING ELECTRODE SYSTEM

A. The BCT between the TMGB and the ac service equipment ground shall not be smaller than No. 1/0 AWG.

3.5 GROUNDING BUSBARS

A. Indicate locations of grounding busbars on Drawings. Install busbars horizontally, on insulated spacers 2 inches minimum from wall, 12 inches above finished floor unless otherwise indicated.

3.6 CONNECTIONS

A. Bond metallic equipment in a telecommunications equipment room to the grounding busbar in that room, using equipment grounding conductors not smaller than No. 6 AWG.

B. Stacking of conductors under a single bolt is not permitted when connecting to busbars.

C. Assemble the wire connector to the conductor, complying with manufacturer's written instructions and as follows:

1. Use crimping tool and the die specific to the connector.

2. Pretwist the conductor.

3. Apply an antioxidant compound to all bolted and compression connections.

D. Primary Protector: Bond to the TMGB with insulated bonding conductor.

E. Interconnections: Interconnect all TGBs with the TMGB with the telecommunications backbone conductor. If more than one TMGB is installed, interconnect TMGBs using the grounding equalizer conductor. The telecommunications backbone conductor and grounding equalizer conductor size shall not be less than 2 kcmils/linear foot of conductor length, up to a maximum size of No. 3/0 AWG unless otherwise indicated.

F. Structural Steel: Where the structural steel of a steel frame building is readily accessible within the room or space, bond each TGB and TMGB to the vertical steel of the building frame.

G. Shielded Cable: Bond the shield of shielded cable to the TGB in communications rooms and spaces. Comply with TIA-568-C.1 and TIA-568-C.2 when grounding shielded balanced twisted-pair cables.

3.7 IDENTIFICATION

A. Labels shall be preprinted or computer-printed type.

1. Label TMGB(s) with "fs-TMGB," where "fs" is the telecommunications space identifier for the space containing the TMGB.

2. Label TGB(s) with "fs-TGB," where "fs" is the telecommunications space identifier for the space containing the TGB.
3. Label the BCT and each telecommunications backbone conductor at its attachment point: "WARNING! TELECOMMUNICATIONS BONDING CONDUCTOR. DO NOT REMOVE OR DISCONNECT!"

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
2. Test the bonding connections of the system using an ac earth ground-resistance tester, taking two-point bonding measurements in each telecommunications equipment room containing a TMGB and a TGB and using the process recommended by BICSI TDMM. Conduct tests with the facility in operation.
   a. Measure the resistance between the busbar and the nearest available grounding electrode. The maximum acceptable value of this bonding resistance is 100 milliohms.
3. Test for ground loop currents using a digital clamp-on ammeter, with a full-scale of not more than 10 A, displaying current in increments of 0.01 A at an accuracy of plus/minus 2.0 percent.
   a. With the grounding infrastructure completed and the communications system electronics operating, measure the current in every conductor connected to the TMGB and in each TGB. Maximum acceptable ac current level is 1 A.

C. Excessive Ground Resistance: If resistance to ground at the BCT exceeds 5 ohms, notify Architect promptly and include recommendations to reduce ground resistance.

D. Grounding system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

END OF SECTION

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SECTION 270528

PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Metal conduits and fittings.
2. Hooks.
3. Boxes.

1.3 ACTION SUBMITTALS

A. Product data for the following:

1. Conduit.
2. Hooks.
3. Boxes.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

A. Description: Metal raceway of circular cross section with manufacturer-fabricated fittings.

B. 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. Allied Tube & Conduit; Atkore International.
2. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.
3. Wheatland Tube; Zekelman Industries.

C. General Requirements for Metal Conduits and Fittings:

1. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.
2. Comply with TIA-569-D.

D. EMT: Comply with ANSI C80.3 and UL 797.

E. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

1. Fittings for EMT:
   a. Material: Steel or die cast.
   b. Type: Compression.

2.2 HOOKS

A. Description: Prefabricated sheet metal cable supports for telecommunications cable.

B. 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. MonoSystems, Inc.
2. Panduit Corp.
3. Wiremold; Legrand North America, LLC.

C. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

D. Comply with TIA-569-D.

E. Galvanized steel.

F. J shape.

2.3 BOXES

A. Description: Enclosures for communications.

B. 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. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.
2. Raco Taymac Bell; brand of Hubbell Electrical Solutions; Hubbell Incorporated.
3. Spring City Electrical Manufacturing Company.

C. General Requirements for Boxes:

1. Comply with TIA-569-D.
2. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
3. Gangable boxes are prohibited.

D. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

PART 3 - EXECUTION

3.1 PATHWAY APPLICATION

A. Indoors: Apply pathway products as specified below unless otherwise indicated:

1. Exposed: EMT.
2. Concealed in Ceilings and Interior Walls and Partitions: EMT.
3. Boxes: NEMA 250, Type 1.

B. Minimum Pathway Size: 3/4-inch trade size.

C. Pathway Fittings: Compatible with pathways and suitable for use and location.

1. EMT: Use compression, steel or cast-metal fittings. Comply with NEMA FB 2.10.

3.2 INSTALLATION

A. Comply with the following standards for installation requirements except where requirements on Drawings or in this Section are stricter:

1. NECA 1.
2. NECA/BICSI 568.
3. TIA-569-D.
4. NECA 101
5. NECA 102.
6. NECA 105.
7. NECA 111.

B. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.

C. Comply with requirements in Division 07 for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.

D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

E. Keep pathways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.

F. Complete pathway installation before starting conductor installation.

G. Install no more than the equivalent of two 90-degree bends in any pathway run. Support within 12 inches of changes in direction. Utilize long radius ells for all optical-fiber cables.

H. Conceal conduit within finished walls, and ceilings unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

I. Support conduit within 12 inches of enclosures to which attached.

J. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus one additional quarter-turn.

K. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure, to assure a continuous ground path.

L. Cut conduit perpendicular to the length. For conduits of 2-inch trade size and larger, use roll cutter or a guide to ensure cut is straight and perpendicular to the length.

M. Install pull wires in empty pathways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Secure pull wire, so it cannot fall into conduit. Cap pathways designated as spare alongside pathways in use.

N. Install pathway-sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed pathways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install pathway-sealing fittings according to NFPA 70.

O. Install devices to seal pathway interiors at accessible locations. Locate seals, so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all pathways at the following points:

   1. Where otherwise required by NFPA 70.

P. Comply with manufacturer's written instructions for solvent welding PVC conduit and fittings.

Q. Hooks:

   1. Size to allow a minimum of 25 percent future capacity without exceeding design capacity limits.

   2. Shall be supported by dedicated support wires. Do not use ceiling grid support wire or support rods.

   3. Hook spacing shall allow no more than 6 inches of slack. The lowest point of the cables shall be no less than 6 inches adjacent to ceilings, mechanical ductwork and fittings, luminaires, power conduits, power and telecommunications outlets, and other electrical and communications equipment.

   4. Space hooks no more than 5 feet o.c.

   5. Provide a hook at each change in direction.

R. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

S. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surface to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

T. Horizontally separate boxes mounted on opposite sides of walls, so they are not in the same vertical channel.

U. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

V. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

3.3 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Division 07.

END OF SECTION

SECTION 271100

COMMUNICATIONS EQUIPMENT ROOM FITTINGS

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. Backboards.

1.3 DEFINITIONS

A. Access Provider: An operator that provides a circuit path or facility between the service provider and user. An access provider can also be a service provider.

B. BICSI: Building Industry Consulting Service International.

C. RCDD: Registered communications distribution designer.

D. TGB: Telecommunications grounding bus bar.

E. TMGB: Telecommunications main grounding bus bar.

PART 2 - PRODUCTS

2.1 BACKBOARDS

A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches.

B. Backboard Paint: Light-colored fire-retardant paint.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.

B. Comply with BICSI's "Telecommunications Distribution Methods Manual" for layout of communications equipment spaces.

C. Comply with BICSI's "Information Technology Systems Installation Methods Manual" for installation of equipment in communications equipment spaces.

D. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

E. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

F. Backboards:

1. Install from 6 inches to 8 feet, 6 inches above finished floor. If plywood is fire rated, ensure that fire-rating stamp is visible after installation.

2. Paint all sides of backboard with two coats of paint, leaving fire rating stamp visible.

3. Comply with requirements for backboard installation in BICSI's "Information Technology Systems Installation Methods Manual" and TIA-569-D.

3.2 SLEEVE AND SLEEVE SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.3 FIRESTOPPING

A. Comply with requirements in Division 07.

B. Comply with TIA-569-D, Annex A, "Firestopping."

C. Comply with BICSI's "Information Technology Systems Installation Methods Manual," "Firestopping Practices" Ch.

END OF SECTION

SECTION 271513
COMMUNICATIONS COPPER HORIZONTAL CABLING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Category 6 twisted pair cable.
2. Grounding provisions for twisted pair cable.

1.2 COPPER HORIZONTAL CABLING DESCRIPTION

A. Cabling system consists of horizontal cables.

1. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications equipment outlet.
2. Bridged taps and splices shall not be installed in the horizontal cabling.

B. The maximum allowable horizontal cable length is 295 feet.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA-568-C.1, when tested according to test procedures of this standard.

B. Telecommunications Pathways and Spaces: Comply with TIA-569-D.

C. Grounding: Comply with TIA-607-B.

2.2 GENERAL CABLE CHARACTERISTICS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with the applicable standard and NFPA 70 for the following types:

1. Communications, Plenum Rated: Type CMP complying with UL 1685.
2. Communications, Non-plenum: Type CMR complying with UL 1666.

B. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.

C. RoHS compliant.

2.3 CATEGORY 6 TWISTED PAIR CABLE

A. Description: Four-pair, balanced-twisted pair cable, certified to meet transmission characteristics of Category 6a cable at frequencies up to 500MHz.

B. 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. AMP NETCONNECT; a TE Connectivity Ltd. company.
2. Berk-Tek Leviton; a Nexans/Leviton alliance.

3. General Cable; Prysmian Group North America.

C. Standard: Comply with TIA-568-C.2 for Category 6 cables.

D. Conductors: 100-ohm, 23 AWG solid copper.

E. Shielding/Screening: Shielded twisted pairs (FTP).

F. Cable Rating: Plenum.

G. Jacket: Blue thermoplastic.

2.4 GROUNDING

A. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.

B. Comply with TIA-607-B.

PART 3 - EXECUTION

3.1 INSTALLATION OF TWISTED-PAIR HORIZONTAL CABLES

A. Comply with NECA 1 and NECA/BICSI 568.

B. Wiring Method: Install cables in raceways except in accessible ceiling spaces, where unenclosed wiring method may be used. Conceal raceway and cables, except in unfinished spaces.

1. Install plenum cable in environmental air spaces, including plenum ceilings.

2. Comply with requirements for raceways and boxes specified in Section 270528 "Pathways for Communications Systems."

C. General Requirements for Cabling:

1. Comply with TIA-568-C.1.

2. Comply with BICSI's Information Transport Systems Installation Methods Manual, Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section.

3. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from boxes, and outlets.

4. Install lacing bars to restrain cables, prevent straining connections, and prevent bending cables to smaller radii than minimums recommended by manufacturer.

5. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation, and replace it with new cable.

6. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.

7. In the communications equipment room, install a 10-foot-long service loop on each end of cable.

8. Pulling Cable: Comply with BICSI Information Transport Systems Installation Methods Manual, Ch. 5, "Copper Structured Cabling Systems," "Pulling and Installing Cable" Section. Monitor cable pull tensions.

D. Separation from EMI Sources:

1. Comply with recommendations from BICSI's "Telecommunications Distribution Methods Manual" and TIA-569-D for separating unshielded copper communication cable from potential EMI sources, including electrical power lines and equipment.

3.2 FIRESTOPPING

A. Comply with requirements in Division 07.

B. Comply with TIA-569-D, Annex A, "Firestopping."

C. Comply with "Firestopping Systems" Article in BISCI's "Telecommunications Distribution Methods Manual."

3.3 GROUNDING

A. Install grounding according to the "Grounding, Bonding, and Electrical Protection" chapter in BICSI's "Telecommunications Distribution Methods Manual."

B. Comply with TIA-607-B and NECA/BICSI-607.

3.4 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA-606-B. Comply with requirements for identification specified in Section 270553 "Identification for Communications Systems."

B. Paint and label colors for equipment identification shall comply with TIA-606-B.

C. Cable and Wire Identification:

1. Label each cable where it is accessible in a junction or outlet box, and elsewhere as indicated.
2. Each wire connected to building-mounted devices is not required to be numbered at the device if wire color is consistent with associated wire connected and numbered within panel or cabinet.
3. Exposed Cables: Label each cable at intervals not exceeding 15 feet.

D. Labels shall be preprinted or computer-printed type, with a printing area and font color that contrast with cable jacket color but still comply with TIA-606-B requirements for the following:

1. Cables use flexible vinyl or polyester that flexes as cables are bent.

3.5 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Visually inspect jacket materials for NRTL certification markings..
2. Visually inspect cable placement, and labeling of all components.
3. Test twisted pair cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors.

B. Remove and replace cabling where test results indicate that they do not comply with specified requirements.

C. End-to-end cabling will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION

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SECTION 284621.11

ADDRESSABLE FIRE-ALARM SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Addressable fire-alarm system.
2. Fire-alarm control unit (FACU).
3. Manual fire-alarm boxes.
4. System smoke detectors.
5. Duct smoke detectors.
6. Carbon monoxide detectors.
7. Heat detectors.
8. Fire-alarm notification appliances.
9. Fire-alarm addressable interface devices.
10. Digital alarm communicator transmitters (DACTs).

B. Delineation of Work: The Electrical Contractor shall provide all required raceway, boxes, conductors and cables required for a complete fire alarm system. The Fire Alarm System Vendor shall provide all required fire alarm system equipment and devices for a complete fire alarm system. The Fire Alarm System Vendor shall program and test the fire alarm system.

C. Related Requirements:

1. Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for cables and conductors for fire-alarm systems.

1.3 DEFINITIONS

A. DACT: Digital alarm communicator transmitter.

B. EMT: Electrical metallic tubing.

C. FACU: Fire-alarm control unit.

D. NICET: National Institute for Certification in Engineering Technologies.

E. Voltage Class: For specified circuits and equipment, voltage classes are defined as follows:

1. Control Voltage: Listed and labeled for use in remote-control, signaling, and power-limited circuits supplied by a Class 2 or Class 3 power supply having rated output not greater than 150 V and 5 A, allowing use of alternate wiring methods complying with NFPA 70, Article 725.
2. Low Voltage: Listed and labeled for use in circuits supplied by a Class 1 or other power supply having rated output not greater than 1000 V, requiring use of wiring methods complying with NFPA 70, Article 300, Part I.

1.4 ACTION SUBMITTALS

A. Approved Permit Submittal: Submittals must be approved by authorities having jurisdiction prior to submitting them to Architect.

B. Product Data: For each type of product, including furnished options and accessories.

1. Include construction details, material descriptions, dimensions, profiles, and finishes.
2. Include rated capacities, operating characteristics, and electrical characteristics.

C. Shop Drawings: For fire-alarm system.

1. Comply with recommendations and requirements in "Documentation" section of "Fundamentals" chapter in NFPA 72.
2. Include plans, elevations, sections, and details, including details of attachments to other Work.
3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
4. Detail assembly and support requirements.
5. Include voltage drop calculations for notification-appliance circuits.
6. Include battery-size calculations.
7. Include input/output matrix.
8. Include written statement from manufacturer that equipment and components have been tested as a system and comply with requirements in this Section and in NFPA 72.
9. Include performance parameters and installation details for each detector.
10. Verify that each duct detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
11. Provide control wiring diagrams for fire-alarm interface to HVAC; coordinate location of duct smoke detectors and access to them.
    a. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators.
    b. Show field wiring required for HVAC unit shutdown on alarm.
    c. Locate detectors in accordance with manufacturer's written instructions.
12. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits and point-to-point wiring diagrams.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Qualification Statements: For Installer.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Division 01, include the following:
    a. Comply with "Records" section of "Inspection, Testing and Maintenance" chapter in NFPA 72.
    b. Provide "Fire-Alarm and Emergency Communications System Record of Completion Documents" in accordance with "Completion Documents" Article in "Documentation" section of "Fundamentals" chapter in NFPA 72.
    c. Complete wiring diagrams showing connections between devices and equipment. Each conductor must be numbered at every junction point with indication of origination and termination points.
    d. Riser diagram.
    e. Device addresses.
    f. Air-sampling system sample port locations.
    g. Record copy of site-specific software.

h. Provide "Inspection and Testing Form" in accordance with "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:

1) Equipment tested.

2) Frequency of testing of installed components.

3) Frequency of inspection of installed components.

4) Requirements and recommendations related to results of maintenance.

5) Manufacturer's user training manuals.

i. Manufacturer's required maintenance related to system warranty requirements.

j. Abbreviated operating instructions for mounting at FACU and each annunciator unit.

1.7 QUALITY ASSURANCE

A. Installer Qualifications:

1. Personnel must be trained and certified by manufacturer for installation of units required for this Project.

2. Installation must be by personnel certified by NICET as fire-alarm Level III technician.

3. Obtain certification by NRTL in accordance with NFPA 72.

4. Licensed or certified by authorities having jurisdiction.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail because of defects in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ADDRESSABLE FIRE-ALARM SYSTEM

A. Description:

1. Noncoded, UL-certified addressable system, with multiplexed signal transmission and horn-and-strobe notification for evacuation.

B. Performance Criteria:

1. Regulatory Requirements:

a. Fire-Alarm Components, Devices, and Accessories: Listed and labeled by a NRTL in accordance with NFPA 70 for use with selected fire-alarm system and marked for intended location and application.

2. General Characteristics:

a. Fire-alarm signal initiation must be by one or more of the following devices and systems:

1) Manual stations.

2) Heat detectors.

3) Smoke detectors.

4) Duct smoke detectors.

5) Carbon monoxide detectors.

6) Automatic sprinkler system water flow.

7) Dry system pressure flow switch.

b. Fire-alarm signal must initiate the following actions:

1) Continuously operate alarm notification appliances.

2) Identify alarm and specific initiating device at FACU.

3) Transmit alarm signal to remote alarm receiving station.

4) Switch HVAC equipment controls to fire-alarm mode.

5) Recall elevators to primary or alternate recall floors.

6) Activate elevator power shunt trip.

7) Record events in system memory.

c. Supervisory signal initiation must be by one or more of the following devices and actions:

1) Valve supervisory switch.

2) High- or low-air-pressure switch of dry-pipe sprinkler system.

3) Elevator shunt-trip supervision.

4) Zones or individual devices have been disabled.

5) FACU has lost communication with network.

d. System trouble signal initiation must be by one or more of the following devices and actions:

1) Open circuits, shorts, and grounds in designated circuits.

2) Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.

3) Loss of communication with addressable sensor, input module, relay, control module, remote annunciator, printer interface, or Ethernet module.

4) Loss of primary power at FACU.

5) Ground or single break in internal circuits of FACU.

6) Abnormal ac voltage at FACU.

7) Break in standby battery circuitry.

8) Failure of battery charging.

9) Abnormal position of switch at FACU or annunciator.

e. System Supervisory Signal Actions:

1) Initiate notification appliances.

2) Identify specific device initiating event at FACU.

3) After time delay of 200 seconds, transmit trouble or supervisory signal to remote alarm receiving station.

f. Device Guards:

1) Description: Welded wire mesh of size and shape for manual station, smoke detector, gong, or other device requiring protection.

a) Factory fabricated and furnished by device manufacturer.

b) Finish: Paint of color to match protected device.

g. Document Storage Box:

1) Description: Enclosure to accommodate standard 8-1/2-by-11 inch manuals and loose document records. Legend sheet will be permanently attached to door for system required documentation, key contacts, and system information. Provide two key ring holders with location to mount standard business cards for key contact personnel.

2) Material and Finish: 18-gauge cold-rolled steel; four mounting holes.

3) Color: Red powder-coat epoxy finish.

4) Labeling: Permanently screened with 1 inch high lettering "SYSTEM RECORD DOCUMENTS" with white indelible ink.

5) Security: Locked with 3/4 inch barrel lock. Provide solid 12 inch stainless steel piano hinge.

2.2 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Edwards; Carrier Global Corporation.
2. Notifier; Honeywell International, Inc.
3. Siemens Industry, Inc., Building Technologies Division.
4. Silent Knight; Honeywell International, Inc.
5. Simplex; brand of Johnson Controls International plc, Building Solutions North America.

B. Service Contract: Manufacturer shall have an open service contract that does not limit service and testing to only be performed by a single vendor.

2.3 FIRE-ALARM CONTROL UNIT (FACU)

A. Description: Field-programmable, microprocessor-based, modular, power-limited design with electronic modules.

B. Performance Criteria:

1. Regulatory Requirements: Comply with NFPA 72 and UL 864.

2. General Characteristics:

a. System software and programs must be held in nonvolatile flash, electrically erasable, programmable, read-only memory, retaining information through failure of primary and secondary power supplies.

b. Include real-time clock for time annotation of events on event recorder and printer.

c. FACU must be listed for connection to central-station signaling system service.

d. Provide nonvolatile memory for system database, logic, and operating system and event history. System must require no manual input to initialize in the event of complete power down condition. FACU must provide minimum 500-event history log.

e. Addressable Initiation Device Circuits: FACU must indicate which communication zones have been silenced and must provide selective silencing of alarm notification appliance by building communication zone.

1) Addressable Control Circuits for Operation of Notification Appliances and Mechanical Equipment: FACU must be listed for releasing service.

f. Fire-Alarm Annunciator: Arranged for interface between human operator at FACU and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and programming and control menu.

1) Annunciator and Display: LCD, 80 characters, minimum.

2) Keypad: Arranged to permit entry and execution of programming, display, and control commands.

g. Initiating-Device, Notification-Appliance, and Signaling-Line Circuits:

1) Pathway Class Designations: NFPA 72, Class B.

2) Pathway Survivability: Level 1.

3) Install no more than 50 addressable devices on each signaling-line circuit.

4) Install fault circuit isolators to comply with circuit performance requirements of NFPA 72 or with manufacturer's written instructions, whichever is more conservative.

h. Serial Interfaces:

1) One dedicated RS 485 port for central-station operation using point ID DACT.

2) One RS 485 port for remote annunciators, Ethernet module, or multi-interface module (printer port).

3) One USB or RS 232 port for PC configuration.

i. Notification-Appliance Circuit:

1) Audible appliances must sound in three-pulse temporal pattern, as defined in NFPA 72.

2) Visual alarm appliances must flash in synchronization where multiple appliances are in same field of view, as defined in NFPA 72.

j. Elevator Recall: Initiate by one of the following alarm-initiating devices:

1) Elevator lobby detectors except lobby detector on designated floor.

2) Smoke detectors in elevator machine room.

3) Smoke detectors in elevator hoistway.

k. Elevator controller must be programmed to move cars to alternate recall floor if lobby detectors located on designated recall floors are activated.

l. Water-flow alarm connected to sprinkler in elevator shaft and elevator machine room must shut down elevators associated with location without time delay.

1) Water-flow switch associated with sprinkler in elevator pit may have delay to allow elevators to move to designated floor.

m. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to remote alarm station.

n. Primary Power: 24 V(dc) obtained from 120 V(ac) service and power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, and supervisory and DACT must be powered by 24 V(dc) source.

o. Alarm current draw of entire fire-alarm system must not exceed 80 percent of power-supply module rating.

p. Secondary Power: 24 V(dc) supply system with batteries, automatic battery charger, and automatic transfer switch.

q. Batteries: Sealed lead calcium.

C. Accessories:

1. Instructions: Computer printout or typewritten instruction card mounted behind plastic or glass cover in stainless steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe functional operation of system under normal, alarm, and trouble conditions.

2.4 MANUAL FIRE-ALARM BOXES

A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes must be finished in red with molded, raised-letter operating instructions in contrasting color; must show visible indication of operation; and must be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.

1. Single-action mechanism, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to FACU.

2. Station Reset: Key- or wrench-operated switch.

3. Indoor Protective Shield: Factory-fabricated, clear plastic enclosure hinged at top to permit lifting for access to initiate alarm.
4. Material: Manual stations made of Lexan polycarbonate.
5. Able to be used in indoor areas.

2.5 SYSTEM SMOKE DETECTORS

A. Photoelectric Smoke Detectors:
1. Performance Criteria:
a. Regulatory Requirements:
1) NFPA 72.
2) UL 268.
b. General Characteristics:
1) Detectors must be four or two-wire type.
2) Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to FACU.
3) Base Mounting: Detector and associated electronic components must be mounted in twist-lock module that connects to fixed base. Provide terminals in fixed base for connection to building wiring.
4) Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
5) Integral Visual-Indicating Light: LED type, indicating detector has operated.
6) Detector address must be accessible from FACU and must be able to identify detector's location within system and its sensitivity setting.
7) Detector must have functional humidity range within 10 to 90 percent relative humidity.
8) Color: White.
9) Rate-of-rise temperature characteristic of combination smoke- and heat-detection units must be selectable at FACU for 15 or 20 deg F per minute.
10) Fixed-temperature sensing characteristic of combination smoke- and heat-detection units must be independent of rate-of-rise sensing and must be settable at FACU to operate at 135 or 155 deg F.
11) Multiple levels of detection sensitivity for each sensor.

2.6 DUCT SMOKE DETECTORS

A. Description: Photoelectric-type, duct-mounted smoke detector.
B. Performance Criteria:
1. Regulatory Requirements:
a. NFPA 72.
b. UL 268A.
2. General Characteristics:
a. Detectors must be four or two-wire type.
b. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to FACU.
c. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.

d. Integral Visual-Indicating Light: LED type, indicating detector has operated.

e. Detector address must be accessible from FACU and must be able to identify detector's location within system and its sensitivity setting.

f. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with supplied detector for smoke detection in HVAC system ducts.

g. Each sensor must have multiple levels of detection sensitivity.

h. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.

i. Relay Fan Shutdown: Fully programmable relay rated to interrupt fan motor-control circuit.

2.7 CARBON MONOXIDE DETECTORS

A. Description: Carbon monoxide detector listed for connection to fire-alarm system.

B. Performance Criteria:

1. Regulatory Requirements:

a. NFPA 72

b. NFPA 720.

c. UL 2075.

2. General Characteristics:

a. Mounting: Adapter plate for outlet box mounting.

b. Testable by introducing test carbon monoxide into sensing cell.

c. Detector must provide alarm contacts and trouble contacts.

d. Detector must send trouble alarm when nearing end-of-life, power supply problems, or internal faults.

e. Locate, mount, and wire in accordance with manufacturer's written instructions.

f. Provide means for addressable connection to fire-alarm system.

g. Test button simulates alarm condition.

2.8 HEAT DETECTORS

A. Combination-Type Heat Detectors:

1. Performance Criteria:

a. Regulatory Requirements:

1) NFPA 72.

2) UL 521.

b. General Characteristics:

1) Temperature sensors must test for and communicate sensitivity range of device.

c. Actuated by fixed temperature of 135 deg F or rate of rise that exceeds 15 deg F per minute unless otherwise indicated.

d. Mounting: Twist-lock base interchangeable with smoke-detector bases.

e. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to FACU.

f. Detector must have functional humidity range of 10 to 90 percent relative humidity.

g. Color: White.

2.9 FIRE-ALARM NOTIFICATION APPLIANCES

A. Fire-Alarm Audible Notification Appliances:

1. Description: Horns, bells, or other notification devices that cannot output voice messages.
2. Performance Criteria:
   a. Regulatory Requirements:
      1) NFPA 72.
   b. General Characteristics:
      1) Individually addressed, connected to signaling-line circuit, equipped for mounting as indicated, and with screw terminals for system connections.
      2) Connected to notification-appliance signal circuits, zoned as indicated, equipped for mounting as indicated, and with screw terminals for system connections.
      3) Audible notification appliances must have functional humidity range of 10 to 95 percent relative humidity.
      4) Horns: Electric-vibrating-polarized type, 24 V(dc); with provision for housing operating mechanism behind grille. Comply with UL 464. Horns must produce sound-pressure level of 90 dB(A-weighted), measured 10 ft. from horn, using coded signal prescribed in UL 464 test protocol.
      5) Combination Devices: Factory-integrated audible and visible devices in single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.

B. Fire-Alarm Visible Notification Appliances:

1. Performance Criteria:
   a. Regulatory Requirements:
      1) NFPA 72.
      2) UL 1971.
   b. General Characteristics:
      1) Rated Light Output:
         a) 15/30/75/110 cd, selectable in field.
      2) Clear or nominal white polycarbonate lens mounted on aluminum faceplate.
      3) Mounting: Wall mounted unless otherwise indicated.
      4) For units with guards to prevent physical damage, light output ratings must be determined with guards in place.
      5) Flashing must be in temporal pattern, synchronized with other units.
      6) Strobe Leads: Factory connected to screw terminals.
      7) Mounting Faceplate: Factory finished, red.

2.10 FIRE-ALARM ADDRESSABLE INTERFACE DEVICES

A. Performance Criteria:

1. Regulatory Requirements:
   a. NFPA 72.
2. General Characteristics:
   a. Include address-setting means on module.
   b. Store internal identifying code for control panel use to identify module type.
   c. Listed for controlling HVAC fan motor controllers.

d. Monitor Module: Microelectronic module providing system address for alarm-initiating devices for wired applications with normally open contacts.

e. Integral Relay: Capable of providing direct signal to elevator controller to initiate elevator recall and to circuit-breaker shunt trip for power shutdown.

1) Allow control panel to switch relay contacts on command.

2) Have minimum of two normally open and two normally closed contacts available for field wiring.

f. Control Module:

1) Operate notification devices.

2) Operate solenoids for use in sprinkler service.

2.11 DIGITAL ALARM COMMUNICATOR TRANSMITTERS (DACTs)

A. Performance Criteria:

1. Regulatory Requirements:

a. NFPA 72.

2. General Characteristics:

a. DACT must be acceptable to remote central station and must be listed for fire-alarm use.

b. Functional Performance: Unit must receive alarm, supervisory, or trouble signal from FACU and automatically capture two telephone lines and dial preset number for remote central station. When contact is made with central station, signals must be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter must initiate local trouble signal and transmit signal indicating loss of telephone line to remote alarm receiving station over remaining line. Transmitter must automatically report telephone service restoration to central station. If service is lost on both telephone lines, transmitter must initiate local trouble signal.

c. Local functions and display at DACT must include the following:

1) Verification that both telephone lines are available.

2) Programming device.

3) LED display.

4) Manual test report function and manual transmission clear indication.

5) Communications failure with central station or FACU.

d. Digital data transmission must include the following:

1) Address of alarm-initiating device.

2) Address of supervisory signal.

3) Address of trouble-initiating device.

4) Loss of ac supply.

5) Loss of power.

6) Low battery.

7) Abnormal test signal.

8) Communication bus failure.

e. Secondary Power: Integral rechargeable battery and automatic charger.

f. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.

1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.

B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.

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

3.2 PREPARATION

A. Preinstallation Testing: Perform verification of functionality of installed components of existing system prior to starting work. Document equipment or components not functioning as designed.

B. Interruption of Existing Fire-Alarm Service: Do not interrupt fire-alarm service to facilities occupied by Owner or others unless permitted under the following:

1. Notify Construction Manager no fewer than ten days in advance of proposed interruption of fire-alarm service.

2. Do not proceed with interruption of fire-alarm service without Construction Manager's written permission.

3.3 INSTALLATION OF EQUIPMENT

A. Comply with NECA 305, NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."

1. Devices placed in service before other trades have completed cleanup must be replaced.

2. Devices installed, but not yet placed, in service must be protected from construction dust, debris, dirt, moisture, and damage in accordance with manufacturer's written storage instructions.

B. Install wall-mounted equipment, with tops of cabinets not more than 78 inch above finished floor.

C. Manual Fire-Alarm Boxes:

1. Install manual fire-alarm box in normal path of egress within 60 inch of exit doorway.

D. Smoke- and Heat-Detector Spacing:

1. Comply with "Smoke-Sensing Fire Detectors" section in "Initiating Devices" chapter in NFPA 72, for smoke-detector spacing.

2. Comply with "Heat-Sensing Fire Detectors" section in "Initiating Devices" chapter in NFPA 72, for heat-detector spacing.

3. Smooth ceiling spacing must not exceed 30 ft.

4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas must be determined in accordance with Annex A or Annex B in NFPA 72.

5. HVAC: Locate detectors not closer than 36 inches from air-supply diffuser or return-air opening.

6. Lighting Fixtures: Locate detectors not closer than 12 inches from lighting fixture and not directly above pendant mounted or indirect lighting.

E. Install cover on each smoke detector that is not placed in service during construction. Cover must remain in place except during system testing. Remove cover prior to system turnover.

F. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend full width of duct. Tubes more than 36 inch long must be supported at both ends.

1. Do not install smoke detector in duct smoke-detector housing during construction. Install detector only during system testing and prior to system turnover.

G. Air-Sampling Smoke Detectors: If using multiple pipe runs, runs must be pneumatically balanced.

H. Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location. Do not install smoke detectors in sprinklered elevator shafts.

I. Remote Status and Alarm Indicators: Install in visible location near each smoke detector, sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position.

J. Device Location-Indicating Lights: Locate in public space near device they monitor.

3.4 ELECTRICAL CONNECTIONS

A. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."

C. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.

3.5 PATHWAYS

A. Pathways must be installed in EMT.

3.6 CONNECTIONS

A. Make addressable connections with supervised interface device to the following devices and systems. Install interface device less than 36 inch from device controlled. Make addressable confirmation connection when such feedback is available at device or system being controlled.

1. Alarm-initiating connection to elevator recall system and components.
2. Supervisory connections at valve supervisory switches.
3. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
4. Supervisory connections at elevator shunt-trip breaker.

3.7 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. Install framed instructions in location visible from FACU.

3.8 GROUNDING

A. Ground FACU and associated circuits in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."

B. Ground shielded cables at control panel location only. Insulate shield at device location.

3.9 FIELD QUALITY CONTROL

A. Field tests must be witnessed by authorities having jurisdiction, if requested.

B. Administrant for Tests and Inspections:

1. Engage factory-authorized service representative to administer and perform tests and inspections on components, assemblies, and equipment installations, including connections.

C. Tests and Inspections:

1. Visual Inspection: Conduct visual inspection prior to testing.

   a. Inspection must be based on completed record Drawings and system documentation that is required by "Completion Documents, Preparation" table in "Documentation" section of "Fundamentals" chapter in NFPA 72.

   b. Comply with "Visual Inspection Frequencies" table in "Inspection" section of "Inspection, Testing and Maintenance" chapter in NFPA 72; retain "Initial/Reacceptance" column and list only installed components.

2. System Testing: Comply with "Test Methods" table in "Testing" section of "Inspection, Testing and Maintenance" chapter in NFPA 72.

3. Test audible appliances for private operating mode in accordance with manufacturer's written instructions.

4. Test visible appliances for public operating mode in accordance with manufacturer's written instructions.

5. Factory-authorized service representative must prepare "Fire Alarm System Record of Completion" in "Documentation" section of "Fundamentals" chapter in NFPA 72 and "Inspection and Testing Form" in "Records" section of "Inspection, Testing and Maintenance" chapter in NFPA 72.

D. Reacceptance Testing: Perform reacceptance testing to verify proper operation of added or replaced devices and appliances.

E. Fire-alarm system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

G. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

H. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.10 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system

END OF SECTION

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SECTION 311000
CLEARING, DEMOLITION, AND MATERIAL DISPOSAL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnish all labor, materials, equipment, tools, and appurtenances required to complete the clearing and demolition to the limits indicated on the Drawings and properly disposing of all waste materials during and as the result of the construction operations under this Contract, as specified or required.

1.02 REFERENCE STANDARDS

A. In order to prevent environmental pollution arising from the construction activities related to the performance of this Contract, the Contractor and subcontractors shall comply with all applicable Federal, State, and local laws and regulations concerning waste material disposal, as well as the specific requirements stated in this Section and elsewhere in the Specifications.

B. The Contractor is advised that the disposal of excess excavated material in wetlands, stream corridors, and plains is strictly prohibited even if the permission of the property owner is obtained. Any violation of this restriction by the Contractor or any person employed by Contractor, will be brought to the immediate attention of the responsible regulatory agencies, with a request that appropriate action be taken against the offending parties. Therefore, the Contractor will be required to remove the fill at Contractor's own expense and restore the area impacted.

1.03 SUBMITTALS

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

PART 2 PRODUCTS

Not Applicable

PART 3 EXECUTION

3.01 SCOPE

A. Furnish all labor, materials, equipment, tools, and appurtenances required to complete the clearing and demolition to the limits indicated on the Drawings and properly disposing of all waste materials during and as the result of the construction operations under this Contract, as specified or required.

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Erect and maintain temporary barriers and security devices as required, including warning signs and lights, and similar measures, for protection of the Owner, existing site operations, and improvements indicated to remain.

B. Demolished asphalt may be delivered to the Rockland County Solid Waste Management Authority facility in West Nyack, New York, with no charge for a tipping fee. Contractor is responsible for material loading and transportation.

C. Soil resulting from grading operations that is surplus or unsuitable for structural fill is to be disposed of at a solid waste management facility properly registered or permitted to receive such material.

D. If the Contractor dumps any waste or surplus material in unauthorized areas, the Contractor shall remove the material and restore the area to the condition of the adjacent undisturbed area. If necessary, contaminated ground shall be excavated, properly disposed of, and replaced with suitable fill material, compacted and finished with topsoil, all at the expense of the Contractor. The Contractor is responsible for any fines associated with improper disposal of waste material.

3.03 DEMOLITION

A. Demolish and remove site features as shown on the drawings.

B. Use of explosives is not permitted.

C. Conduct demolition to minimize interference with existing site operations.

D. Saw cut and break up asphalt pavement and concrete as specified in the Drawings.

E. Cease operations immediately when adjacent structures appear to be in danger. Notify Engineer. Do not resume operations until directed.

F. Conduct operations with minimum interference to public or private accesses to occupied adjacent structures. Maintain continuous access to site and Facility.

G. Sprinkle work with water to minimize dust.

H. Continuously clean up and remove demolished materials from Site. Do not allow materials to accumulate in building or on-Site.

I. Do not burn or bury materials on-Site; leave Site in clean condition.

END OF SECTION

SECTION 312200
EXCAVATION AND GRADING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnish all labor, materials, equipment, tools, and appurtenances required to complete the work of excavation, rough grading, disposal of excess and unsuitable materials, and other related and incidental work within the designated area and as required for the construction of other work, as shown, specified, or required.

1.02 REFERENCE STANDARDS

A. See Section 31 23 00 – Backfill and Fill

B. See Section 31 10 00 – Clearing, Demolition, and Material Disposal

1.03 SUBMITTALS

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

PART 2 PRODUCTS

Not Applicable

PART 3 EXECUTION

3.01 SCOPE

A. Furnish all labor, materials, equipment, tools, and appurtenances required to complete the work of excavation, rough grading, disposal of excess and unsuitable materials, and other related and incidental work within the designated area and as required for the construction of other work, as shown, specified, or required

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. The Contractor shall plan and conduct operations to prevent damage to existing structures, safeguard people and property, minimize traffic inconvenience, protect the structures to be installed, and provide safe working conditions.

B. The Contractor shall not stockpile any material without the Engineer's approval. Stockpiles that are approved by the Engineer shall be carefully placed and the surrounding area shall be protected by placement of erosion control measures in accordance with local rules and regulations.

C. Excavation and grading shall be carried to the dimensions indicated, specified, or required or as directed by the Engineer to provide sufficient clearance for the construction.

D. Contractor is responsible for all penalties, fines, and repair costs associated with unauthorized excavation or grading below contract grades.

E. Excavation carried below the depths shown, specified, or required, without written directions from the Engineer, shall be refilled to the proper grade with thoroughly compacted subgrade fill material in accordance with Section 31 23 00 – Backfill and Fill.

F. The location for the placement of soil stockpiles and staging of materials shall be designated by the Owner.

G. Excavated material, which is suitable and approved for backfill and fill, shall be placed in stockpiles unless or until it can be placed in the work. Per OSHA regulation, stockpiles shall not be placed close to the side of excavations, where the weight of the material could create a surcharge on such sides. Places for stockpiles shall be only where shown or approved, and shall avoid environmentally sensitive areas. The Contractor shall provide erosion control methods in accordance all applicable local rules and regulations.

H. Excavated material that is suitable as general fill and subbase material shall be used in designated site fill areas. Suitable excavated material must be used prior to importing fill material.

I. Excavated material that is unsuitable as general fill or subbase material shall be disposed of in accordance with applicable requirements as directed by the Engineer.

J. No excavation and grading shall commence until the Contractor has staked out and surveyed the proposed work.

K. Following excavation for swales, concrete structures, outlets, outfalls, pipes, etc., the Contractor shall regrade and add compacted fill as needed in order to achieve required surface for placement of materials as shown in the Drawings. All visible sharp protruding objects shall be removed to a depth such that they can be covered with a minimum of 12 inches of compacted fill.

L. The depth and limit of excavation will be in accordance with these Specifications, Drawings, and the Engineer's direction and will be verified during the course of excavation and grading by the Engineer.

END OF SECTION

SECTION 312 00
BACKFILL AND FILL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnish all labor, materials, equipment, tools, and appurtenances required to complete the work of backfill and fill, including rock fill, backfill, subgrade fill placement, embankments, grading, and other related and incidental work within the designated area and as required for the construction of other work, as shown, specified, or required.

1.02 REFERENCE STANDARDS

A. ASTM D6913 - Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis.

B. ASTM D1557 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).

C. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).

D. ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

E. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.03 SUBMITTALS

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

B. Product Data
   1. Submit product information consisting of material source, grain size distribution, USCS classification, and moisture-density relationship for all fill and backfill materials prior to import for use.
   2. Submit tests to the Engineer for approval before any fill material is used in construction according to the following schedule:
      a. Lab Classification (ASTM D6913 and D2487) – 1 per source, every 5,000 cubic yard.
      b. Liquid limits, Plastic Limit, and Plastic Index (ASTM D4318) – 1 per source, every 5,000 cubic yard.
      c. Lab moisture density Modified Proctor (ASTM D1557) – 1 per source, every 5,000 cubic yard.

PART 2 PRODUCTS

2.01 MATERIALS

A. All fill materials, unless otherwise specified, shall consist of clean, non-plastic, well- drained granular soil from stockpiled material or from borrow areas. All fill material shall meet the approval of the Engineer and the requirements of USCS Classification GW, GP, GM, GC, SW, SP, SM.

B. The maximum particle size shall be as shown on the Drawings.

C. All materials shall be free from all perishable and objectionable materials.

D. Backfill materials for piped utilities shall be not containing deleterious material, refuse, rubble, muck, metal, wood, etc., and no particle greater than 6 inches in size can be used.

E. All fill materials shall be substantially free from organic materials, wood, trash, and other objectionable materials which may be compressible or which cannot be properly compacted. It shall not contain granite blocks, broken concrete, masonry rubble, or other similar materials. It shall have physical properties such that it can be readily spread and compacted to the specified permeability and/or density.

2.02 GENERAL BACKFILL

A. General, non-structural backfill materials are allowed outside of areas of any proposed structure or pavement and shall be natural soil, or materials specified herein, not containing deleterious material, refuse, rubble, muck, metal, wood, organics, etc.

2.03 STRUCTURAL FILL

A. Structural fill material are required within areas of any proposed structure or pavement, and shall be free from roots, organic matter, trash, debris, rocks no larger than 2 inches, and other deleterious materials.

B. Recycled Concrete Aggregate obtained from the Rockland County Solid Waste Management Authority facility in West Nyack New York, may be used for structural fill provided it meets requirements shown on the Drawings and specified herein, as approved by the Engineer. The Contractor is responsible for all transportation.

C. The Contractor shall not place fill prior to the approval of the Engineer. Fill material from a new source location shall not be included in the work prior to the acceptance of testing by the Engineer. Depending on the results, the Engineer shall accept or reject the material or require further testing. The Contractor shall not proceed with construction using this material, prior to acceptance by the Engineer. Should unstable material be encountered, torvane and pocket penetrometer testing may be performed by the Engineer, and no further material shall be placed in the area in question without the approval of the Engineer.

2.04 SUBBASE FILL

A. Fill material placed within 6 inches beneath a surface to be constructed (e.g., asphalt, retaining wall) shall conform to NYSDOT Standard Specification Item Number 733-04A Type 2 or Type 4 subbase course.

B. Fill material placed beneath concrete slabs shall be a minimum 4-inch thick layer of No. 57 Coarse Graded Aggregate to provide uniform support.

2.05 BEDDING SAND

A. Bedding sand shall be free of any sharp objects which could puncture or otherwise cause damage to piping. The material shall be acceptable to the Engineer.

B. Recycled Glass Aggregate obtained from the Rockland County Solid Waste Management Authority facility in Hillburn, New York, may be used for bedding material provided it meets requirements shown on the Drawings and specified herein, as approved by the Engineer. The Contractor is responsible for all transportation.

PART 3 EXECUTION

3.01 SCOPE

A. Furnish all labor, materials, equipment, tools, and appurtenances required to complete the work of backfill and fill, including rock fill, backfill, subgrade fill placement, embankments, grading, and other related and incidental work within the designated area and as required for the construction of other work, as shown, specified, or required.

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Backfill shall not be placed until the structure, pipeline, or other construction component has been inspected in place and approved by the Engineer. The extent of pipe trench left open shall be kept to a minimum.

B. Unless otherwise directed, excavations shall be backfilled as soon as possible after structures are constructed, pipes are laid, and the work is inspected, tested as required and accepted, and permission to backfill has been given by the Engineer. Immediately prior to backfilling, all rubbish, debris, forms and similar materials shall be removed from the excavations.

C. Backfill shall be brought up evenly on each side of structures, and for their full length. The thickness of each compacted layer shall not exceed 12 inches unless specified otherwise or as directed by the Engineer. Care shall be taken to ensure that no damage is done to structures or protective coatings thereon.

D. Where sheeting is withdrawn, all cavities left thereby shall be filled with structural fill soil, and tamped in place so as to fill all voids thoroughly.

3.03 TRENCH BACKFILL PROCEDURES

A. Pipes shall be bedded and backfilled as shown in the Drawings or as directed by the Engineer. Care shall be taken to place and compact material under pipe haunches.

B. Trenches shall be backfilled by hand to a depth of not less than 12 inches above the top of the pipe, for the full width of the trench. Such backfill shall be uniformly placed in 6-inch maximum layers. Care shall be taken not to damage the pipe. Each layer shall be hand tamped and compacted before the next layer is placed. After the trench has been backfilled to 12 inches above the top of the pipe, backfill may then be placed and compacted in 12-inch lifts.

3.04 COMPACTION

A. Proof roll general, non-structural backfill with placement equipment, as approved by the engineer.

B. All structural fill, including subbase fill, shall be compacted to at least 95 percent of maximum dry density as determined by Modified Proctor Test (ASTM D1557). The moisture content of the material shall be such that proper compaction shall be obtained. Puddling for compacting will not be permitted.

C. Backfill or fill placed greater than 5 feet below subbase shall be compacted in a manner sufficient to support the proposed loading. Backfill or fill placed in pond berms and not supporting drainage structures, in landscape/grass areas, or for grading outside of the paving areas, shall also be compacted in a manner sufficient to support the proposed loading.

D. Compact pipe backfill to a minimum density of 90 percent of maximum dry density, as determined by Modified Proctor Test (ASTM D1557), unless otherwise specified.

3.05 FILLING

A. Areas on which embankments or other fill will be constructed shall be cleared and prepared for backfilling. Immediately prior to filling, the subgrade shall be proof rolled unless otherwise specified. All unsuitable material as determined by the Engineer shall be removed prior to filling.

B. Fill shall be brought uniformly throughout the area. The thickness of each compacted layer shall not exceed 1 foot unless otherwise specified by the Engineer.

3.06 QUALITY CONTROL

A. Approval of Fill Materials
   1. Backfill material excavated from on-site “uncontrolled fill” sources shall be screened of organic materials to the satisfaction of the Owner and Engineer.
   2. Backfill material sourced off-site shall be from NYSDEC approved mines and free from chemical contamination. Borrow sources must be accessible for inspection and collection of soil samples for chemical and physical testing. The material supplier shall provide a written statement that, to the best of the supplier’s knowledge and belief, the fill from each source provided is not contaminated pursuant to any applicable remediation standards. Backfill material shall not be used until borrow source test results have been submitted and approved.

B. Field Control During Placement
   1. The Contractor is to perform on-site field moisture and density testing on each lift over the entire area of structural fill at one test per 100 foot grid per lift. In place density and water content of soils to be performed in accordance with ASTM D6938.
   2. Any areas not meeting the specified compaction will be reworked or replaced and re-compacted and retested until a passing test is achieved (at no additional cost to the Owner).
   3. In areas where the degree of compaction is doubtful, or the uniformity of materials is not maintained, additional tests will be made as directed by the Engineer.
   4. The Engineer retains the right to perform additional on-site and laboratory testing. The results of such testing are binding and may require the Contractor to perform additional work or reworking of the material at no additional cost to the Owner.

C. The Contractor shall assist the Engineer with this testing as required. The Contractor shall repair damage to finished work caused by the Engineer testing activities.

END OF SECTION

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SECTION 321200
ASPHALT PAVING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnish all labor, materials, equipment, tools, and appurtenances required to complete the work of furnishing and placement of pavement base and surface courses, as well as other work as shown on the Drawings or noted herein which is incidental to roadway construction.

1.02 REFERENCE STANDARDS

A. New York State Department of Transportation (NYSDOT) Standard Specifications, Current Edition.

1.03 SUBMITTALS

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

B. Qualifications
   1. Installer: Company specializing in performing work of this section with minimum ten (10) years documented experience.

C. Product Data
   1. Submit product information for asphalt mix designs and aggregate materials.
   2. Submit mix design with laboratory test results supporting design, including the mixture's maximum theoretical density.

D. Independent Testing Agency
   1. Retain the services of an independent testing agency, unaffiliated with the Contractor, to perform quality assurance testing specified in this section.

PART 2 PRODUCTS

2.01 MATERIALS

A. Asphalt:
   1. Obtain all asphalt materials from an asphalt plant currently approved by the NYSDOT. Asphalt materials must comply with applicable sections of the NYSDOT Standard Specifications, as noted herein and as shown on the Drawings.
   2. Top Course: shall conform to NYSDOT Standard Specifications Item Number 402.125204 Top Course.
      a. 12.5 mm nominal maximum aggregate size.
      b. F2 Friction Condition Aggregate
      c. 50 Series Compaction
   3. Binder Course: shall conform to NYSDOT Standard Specifications Item Number 402.255904 Binder Course.
      a. 25 mm nominal maximum aggregate size.
      b. F9 Frication Condition Aggregate
      c. 50 Series Compaction

B. Subbase Course
   1. Material that will be within six inches of the binder course shall conform to NYSDOT Standard Specification Item Number 733-04A Type 2 or Type 4 subbase course. All material within 6 inches of the binder course shall be compacted to 95% of maximum dry density as determined by Modified Proctor Analysis.

C. Tack Coat
   1. Prime coat and tack coat materials shall conform to NYSDOT Standard Specification.

D. Aggregate Materials
   1. Obtains aggregate from a source approved by the NYSDOT. Aggregate must conform to NYSDOT Standard Specification Section 703-01 for Fine Aggregate and 703-02 for Coarse Aggregate.

E. Joint Materials
   1. Joint materials shall conform to NYSDOT Standard Specification Section 418 – Asphalt Pavement Joint Adhesive

PART 3 EXECUTION

3.01 SCOPE

A. Furnish all labor, materials, equipment, tools, and appurtenances required to complete the work of furnishing and placement of pavement base and surface courses, as well as other work as shown on the Drawings or noted herein which is incidental to roadway construction

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Verify utilities indicated under paving are installed with excavations and trenches backfilled and compacted.

B. Verify compacted subgrade granular subbase is dry and ready to support paving and imposed loads.

C. Verify gradients and elevations of subbase are correct.

D. Verify catch basins and frames are installed in correct position and elevation.

3.03 PREPARATION

A. Saw cut any existing road pavements as indicated on the Drawings, and where needed to meet new pavement, as approved by the Engineer.

B. Compact all subbase to receive asphalt to 95% of the maximum dry density as determined by Modified Proctor Analysis.

3.04 INSTALLATION

A. No asphalt shall be constructed prior to approval of subbase placement and compaction by the Engineer.

B. Do not place asphalt mixture between November 1 and March 1 unless approved by the Engineer.

C. Do not place asphalt mixture when ambient air or base surface temperature is less than 40 degrees F, or surface is wet or frozen.

D. Construct the aggregate subbase as shown on the Drawings and in accordance with the methods detailed in NYSDOT Standard Specification Section 304.

E. Tack coat shall be applied, as needed, in accordance with NYSDOT Standard Specification Section 407.

F. Asphalt binder and top source shall be placed as shown on the Drawings and in accordance with NYSDOT Standard Specification Section 402.

G. Place asphalt top course within 24 hours of applying primer or tack coat.

H. Place binder course to minimum finished thickness indicated on Drawings.

I. Place top course within 24 hours of placing and compacting binder course. When binder course is placed more than 24 hours before placing wearing course, clean surface and apply tack coat before placing wearing course.

J. Compact each course by rolling to specified density. Do not displace or extrude paving from position. Hand compact in areas inaccessible to rolling equipment.

K. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.

L. Apply joint sealer to the interface between new and existing asphalt pavement as shown on the Drawings and in accordance with the manufacturer's recommendations and the methods detailed in the NYSDOT Standard Specifications.

3.05 FIELD QUALITY CONTROL

A. Retain the services of an Independent Testing Contractor to visually inspect compaction and confirm minimum thickness of rolled pavement section.

B. Take samples and perform tests in accordance with the NYSDOT Standard Specifications.
   1. Asphalt Paving Mix Temperature: Measure temperature at time of placement.
   2. Asphalt Paving Thickness: ASTM D3549; test one (1) core sample from every 1,000 square yards compacted paving.

3. Asphalt Paving Density: ASTM D2950 nuclear method; test one (1) location for every 1,000 square yards compacted paving.

C. Acceptance Criteria
1. Asphalt Paving Mix Temperature: as specified in accepted mix design, but in no case less than 250 degrees F.
2. Asphalt Paving Thickness: within ¼ inch of the thickness indicated on the Drawings for each pavement course.
3. Asphalt Paving Density: Greater than or equal to 95% of the mixture's maximum theoretical density.
4. Asphalt Workmanship: The final surface shall be free of ruts, roller marks, raised seams, and cracks.

D. Corrective Action
1. Asphalt placement is in the Contractor's control and corrective actions are considered incidental to the asphalt paving work shown on the Drawings and described in this section.
2. Asphalt Paving Mix Temperature: Do not use asphalt mix outside of the acceptable temperature range.
3. Asphalt Paving Thickness: Place additional top course to achieve the required thickness.
4. Asphalt Paving Density: Perform additional compaction until additional testing of the failed location indicates passing results.
5. Asphalt Workmanship: Areas displaying ruts, roller marks, raised seams, and cracks shall be removed and replaced at the Contractor's expense.

3.06 PROTECTION

A. Traffic shall not be allowed on paved areas prior to final inspection and approval by the Engineer.

END OF SECTION

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SECTION 321313
CONCRETE PAVING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnish all labor, materials, equipment, tools, and appurtenances required to complete the work of furnishing and placement of pavement base and surface courses, as well as other work as shown on the Drawings or noted herein which is incidental to roadway construction.

1.02 REFERENCE STANDARDS

A. New York State Department of Transportation (NYSDOT) Standard Specifications, Current Edition.

1.03 SUBMITTALS

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

B. Qualifications
   1. Installer: Company specializing in performing work of this section with minimum ten (10) years documented experience.

C. Product Data
   1. Submit product information for concrete mix designs and aggregate materials.
   2. Submit manufacturer data for all materials to be used including, but not limited to, admixtures, bonding materials, curing materials, joint materials, and joint sealers.

D. Independent Testing Agency
   1. Retain the services of an independent testing agency, unaffiliated with the Contractor, to perform quality assurance testing specified in this section.

PART 2 PRODUCTS

2.01 MATERIALS

A. Concrete materials, admixtures, bonding materials, curing materials, joint materials, and joint sealers shall be from sources approved by NYSDOT and approved by the Engineer.

B. Concrete Mix Design:
   1. Cementitious Materials: Type I or II
   2. Supplemental Cementitious Materials (e.g., GGBFS): Not to exceed 35% of total cementitious materials.
   3. Compressive Strength: 5,000 psi minimum at 28 days.
   4. Slump: 3” to 5”
   5. Air Entrainment: 5% to 8%
   6. Water to Cement Ratio: not to exceed 0.45

C. Reinforcement:
   1. ASTM A615 Grade 60 for uncoated deformed bars.
   2. ASTM A775 for epoxy-coated deformed bars.

D. Supports for Reinforcement: Use wire bar-type supports complying with Concrete Reinforcing Steel Institute. Use chairs with sand plates or horizontal runners where base material will not support chair legs.
   1. Concrete bricks may be used to support reinforcing. Stagger brick locations.
   2. Supports for epoxy-coated reinforcing shall be either wire bar-type coated with epoxy, plastic, or vinyl compatible with concrete for a minimum distance of 2 inches from point of contact with reinforcing.
   3. Finish (epoxy-coated or galvanized) for supports formed from reinforcing bars shall match finish of supported reinforcing.
   4. Minimum 16-gauge annealed tie wire, ASTM A82: Provide coated wire ties for use with epoxy-coated bars. Acceptable coatings include epoxy, nylon, or vinyl. Do not use plain wire ties.

E. Aggregates: NYSDOT-approved, Section 703-02 (normal weight), from one source.

1. Fine Aggregate: Coarse, clean, sharp, uniformly graded natural sand free of loam, clay , lumps, or other deleterious substances. Less than 10% passing the No. 100 Sieve and less than 3% passing the No. 200 Sieve.
2. Coarse Aggregate: Uniformly graded to 1 ½ inches, clean, processed, crushed stone with low absorption and free of flat/elongated particles. NYSDOT-approved, size 3A gravel can be used to meet large diameter requirement. Gradation similar to blended NYSDOT Type CA 2 and size 1A or ASTM C33 Type 57 and Type 8 blended and modified as follows:

Sieve Size	Percent Passing
1 Inch	95 to 98.5
¾ inch	75 to 94
½ inch	25 to 50
3/8 inch	10 to 25
No. 4	0 to 10

F. Forms: Steel, wood or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects. Coat forms with non-staining type coating will not discolor or deface surface of concrete.

G. Water: Clean, fresh, drinkable.

H. Air Entraining: ASTM C 260.

I. Set-Control Admixtures: Not permitted.

J. Calcium Chloride: Not permitted.

K. Water-Reducing Admixture: "Eucon 37" by Euclid Chemical Co. or "Sikament" by Sika Chemical Corp. Admixture shall conform to ASTM C 494, Type F or G, and not contain more chloride ions than in municipal drinking water.

L. Water-Reducing Admixture: ASTM C 494, Type A.

M. Mid-Range, Water Reducer/Finish Enhancer: ASTM C 494, Type A/F. “Daracem 55” or “Daracem 65” by W.R. Grace or accepted equivalent.

N. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 ounces a square yard and complying with AASHTO M 182, Class 2.

O. Curing-Sheet Materials: ASTM C 171; waterproof paper, polyethylene film, or polyethylene-coated burlap.

P. For slabs exposed to view, provide one of the following or accepted equivalent:
   1. “HydraCure S16" by PNA Construction Technologies.
   2. “UltraCure NCF/SUN” by McTech Group.

Q. Penetrating Exterior Anti-Spalling Sealer: “Euco-Guard VOX” by Euclid Chemical Co. (mixed to 17.5 percent concentration); “Masterseal SL 40” by Master Builders; “Enviroseal 40” by Hydrozo, Inc.; “Aquapel+Plus” by L&M Construction Chemicals; or accepted equivalent.

R. Evaporation Retarder: Monomolecular, film-forming compound applied to exposed concrete slab surfaces for temporary protection from rapid moisture loss. “Aquafilm” by Conspec Manufacturing Co.; “Eucobar” by Euclid Chemical Co.; “Confilm” by Master Builders, Inc.; or accepted equivalent.

S. Crack Repair Material: “Sika Pronto 19” by Sika; “Crack-Fill 4” by Metzger/McGuire; or accepted equivalent.

PART 3 EXECUTION

3.01 SCOPE

A. Furnish all labor, materials, equipment, tools, and appurtenances required to complete the work of furnishing and placement of pavement base and surface courses, as well as other work as shown on the Drawings or noted herein which is incidental to roadway construction

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Verify utilities indicated under paving are installed with excavations and trenches backfilled and compacted.

B. Verify compacted subgrade granular subbase is dry and ready to support paving and imposed loads.

C. Verify gradients and elevations of subbase are correct.

D. Verify catch basins and frames are installed in correct position and elevation.

3.03 PREPARATION

A. Saw cut any existing road pavements as indicated on the Drawings, and where needed to meet new pavement, as approved by the Engineer.

B. Compact all subbase to receive concrete to 95% of the maximum dry density as determined by Modified Proctor Analysis.

3.04 INSTALLATION

A. Do not place concrete mixture when ambient air or base surface temperature is less than 40 degrees F, or surface is wet or frozen.

B. Construct the aggregate subbase as shown on the Drawings and in accordance with the methods detailed in NYSDOT Standard Specification Section 304.

C. Form Construction
   1. Set forms to required grades and lines, rigidly braced and secured.
   2. Install sufficient quantity of forms to allow continuance of work and so that forms remain in place a minimum of 24 hours after concrete placement.
   3. Check completed form work for grade and alignment to follow tolerances:
   4. Top of forms not more that 1/8” in 10'-0”.
   5. Vertical face on longitudinal axis, not more than 1/4” in 10'-0”.
   6. Clean forms after each use, and coat with form release agent as often as required to ensure separation from concrete without damage.

D. Reinforcement Placement
   1. Support reinforcement by metal chairs, runners, bolsters, or concrete brick as required.
   2. Dedicate workers to placement of reinforcement to continuously monitor and adjust reinforcement location during concrete placement.
   3. Touch up damaged epoxy-coated reinforcement in field after placement with epoxy patching material provided by coating manufacturer.

E. Concrete Placement
   1. Do not place concrete until base material and forms have been checked for line and grade. Moisten base material if required to provide uniform dampened condition at time concrete is placed. Concrete shall not be placed around manholes or other structures until they are at the required finish elevation and alignment.
   2. Place concrete using methods which prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Consolidate with care to prevent dislocation of dowels, and joint devices.
   3. Deposit and spread concrete in continuous operation between transverse joints, as far as possible. If interrupted for more than ½ hour, place construction joint.
   4. Consolidate concrete during placing operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
   5. Bring slab surfaces to correct level with a straightedge and strike off. Use darbies to smooth surface, leaving it free of humps or hollows. Do not sprinkle water or portland

cement on plastic surface. Do not disturb slab surfaces before beginning finishing operations.

F. Joint Construction
   1. Contraction Joints: Cut joints to depth of 25% of the slab thickness. Seal contraction joints with NYSDOT standard specification section 705-02 joint sealant.
   2. Expansion/Isolation Joints: Install filler type expansion joint along all outer sides of concrete slab.
   3. Construction Joints: If concrete placement will not occur in one continuous pour, install a construction joint at the location of a planned contraction joint at the end of the pour.

G. Joint Fillers: Extend joint fillers full-width and depth of joint, and not less that ½" or more than 1" below finished surface where joint sealer is indicated. If no joint sealer, place top of joint filler flush with finished concrete surface. Furnish joint fillers in one-piece lengths for full width being placed, wherever possible. Where more than one length is required, lace or clip joint filler sections together.

H. Concrete Finishing
   1. Power Float Finish: Apply power float finish to slab surfaces that will subsequently be trowel finished or covered with waterproofing membrane. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating using float blade or float shoes when surface water has disappeared, when concrete has stiffened sufficiently to permit operation of power- driven floats, or both. Consolidate surface with power-driven floats or by hand-floating if area is small or inaccessible to power units. Check and level surface plane to overall tolerances of FF 18 and FL 13, and minimum local tolerances of FF 13 and FL 10. Cut down high spots and fill low spots. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.
   2. Trowel Finish: Apply trowel finish to monolithic slab surfaces to be exposed to view.
   3. Nonslip Broom Finish: Apply nonslip, heavy broom finish to exterior concrete slab surfaces. Immediately after trowel finishing, roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route.
   4. Delay finishing as long as possible. Allow bleed water to evaporate before finishing.
   5. Finish slabs to specified tolerances given. Patching low spots shall not be permitted. Perform grinding as soon as possible, preferably within 3 days, but not until concrete is sufficiently strong to prevent dislodging coarse aggregate particles.

I. Curing and Protection
   1. Protect freshly placed slabs from premature drying and excessive cold or hot temperature. Maintain without drying at a relatively constant temperature for time period necessary for cement hydration and proper hardening.
   2. Cure exterior slabs completely by moist-curing using burlap absorptive cover, soaker hoses, and ponding for at least 7 days. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4-inch lap over adjacent absorptive covers. Avoid rapid drying at end of curing period. Allow absorptive cover to remain an additional 3 days.
   3. Do not allow foot or other traffic over slabs during 7-day curing period.
   4. Cure slabs or pads 14 days minimum before placing equipment.
   5. Exterior Slabs: Apply penetrating exterior anti-spalling sealer to exterior concrete slabs according to manufacturer's directions.

J. Cleaning and Adjusting
   1. Sweep concrete pavement and wash free of stains, discolorations, dirt and other foreign material just prior to final inspection.
   2. Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials.

3.05 FIELD QUALITY CONTROL

A. Retain the services of an Independent Testing Contractor to visually inspect compaction and confirm minimum thickness of rolled pavement section.

B. Concrete Testing

1. Test each received load for slump and air content.
2. Collect a minimum of one (1) sample per day of concrete placement and every 50 CY of placed concrete.
3. Each sample shall consist of at least six (6) cylinder specimens prepared in accordance with ASTM C31.
4. Specimens shall be tested in accordance with ASTM C39 at the following curing intervals:
   a. 7 days (one cylinder)
   b. 28 days
   c. 56 days (if needed)

3.06 PROTECTION

A. Traffic shall not be allowed on paved areas prior to final inspection and approval by the Engineer.

END OF SECTION

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SECTION 329200
SEED AND MULCH

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnish all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install Seed and Mulch.

1.02 REFERENCE STANDARDS

A. Reference Standards: Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified:
   1. American Joint Committee on Horticultural Nomenclature, Standardized Plant Names.
   2. ASTM C 602, Agricultural Liming Materials.
   3. FSO-F-241D, Fertilizer, Mixed, Commercial.
   4. Official Seed Analyst of North America: Standards of Quality

1.03 SUBMITTALS

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

B. Contractor guarantee of seed and mulch until turf is established.

C. Product Data
   1. Topsoil source and soil test report indicating suitable nutrient and pH to support turf growth.
   2. Certificates from seed vendors for each seed mixture required, stating botanical and common name, percentage by weight and percentages of purity, germination, and weed seed for each species.
   3. Certificates of inspection as may be required by governmental authorities to accompany shipments, and manufacturer's or vendors certified analysis for soil amendments and fertilizer materials.
   4. Manufacturer's specifications and installation instructions for all materials required.

PART 2 PRODUCTS

2.01 MATERIALS

A. Topsoil:
   1. Mineral and organic material free of stones of 1.5 inches in diameter, trash, noxious weeds, and contain less than 10% gravel.

B. Grass
   1. Grass Seed Mixture: Provide fresh, clean, new-crop seed complying with the tolerance for purity and germination established by the Official Seed Analysts of North America. Provide seed of the grass species, proportions, and minimum percentages of purity, germination, and maximum percentage of weed seed, as specified.
   2. Seed for grassed drainage areas shall conform to NYSDEC Standards and Specifications for Erosion and Sediment Control, current edition, Standard Specification for Vegetating Waterways, Seed Mix B:

Common Name	Percent by Weight
Smooth Bromegrass	45
Creeping Red Fescue	35
Perennial Rygrass	20

   3. Seed for landscaped lawn areas shall conform to NYSDOT Lawn Seed Mix.

C. Fertilizer
   1. Standard quality, commercial grade containing 10% total nitrogen, 6% available phosphoric acid and 10% soluble potash applied at manufacturer's recommended rate.

D. Mulch
   1. Provide clean, seed free threshed straw of wheat, rye, oats or barley, free of noxious and invasive seeds, and showing no signs of excessive moisture, mold, or mildew. For

hydroseed applications, provide NYSDOT Type II Cellulose Mulch or Type III Cellulose and Wood Fiber Blend Mulch.

E. Erosion Control Matting:
   1. Provide NYSDOT Class II, Type C, rolled erosion control product for use in erodible areas.

PART 3 EXECUTION

3.01 SCOPE

A. Furnish all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install Seed and Mulch.

B. The extent of seeding and mulching includes all disturbed areas not receiving another specified surface treatment.

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Examine the topsoil, verify elevations and depths of topsoil, observe the conditions under which work is to be performed and notify the Engineer of unsatisfactory conditions. Do not proceed with the work until the unsatisfactory conditions have been corrected in a manner acceptable to the Engineer.

3.03 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Ship turf materials with certificates of inspection as required by governmental authorities. Comply with governing regulations applicable to turf materials.

B. Package standard products with manufacturer's certified analysis. For other materials, provide analysis by recognized laboratory made in accordance with methods established by the Association of Official Analytical Chemists, wherever applicable or as further specified.

C. Delivery of Materials:
   1. Do not deliver seed until site conditions are ready for planting.
   2. Deliver packaged materials in containers showing weight, analysis, and name of manufacturer. Protect materials from deterioration during delivery.
   3. Furnish seed in sealed, standard containers.

3.04 PREPARATION AND INSTALLATION

A. Plant or install materials only during normal planting seasons.

B. Proceed with and complete the turf work as rapidly as portions of the site become available, working within the seasonal limitations for each type of turf required.

C. Do not spread seed when wind velocity exceeds five (5) miles per hour.

D. Do not plant turf when drought, or excessive moisture, or other unsatisfactory conditions prevail.

E. Place a minimum of 4-inches of topsoil over areas to receive seed and mulch. Do not compact.

F. Apply fertilizer according to supplier recommendations, as approved by the Engineer.

G. Areas to be seeded shall be scarified sufficiently to break up the surface crust immediately before seeding. Seed mixture specified shall be applied at a rate of 120 pounds per acre. Any method of distribution such as dry spreader or hydrosphere will be acceptable provided seeds are not damaged during application.

H. Mulch shall be spread uniformly in a continuous blanket of sufficient thickness to completely hide the soil from view. The minimum rate of application is two (2) tons per acre and may be applied by hand or with mechanical means. Mulch shall be applied no more than three (3) days after seeding, unless otherwise approved. Anchorage of the mulch shall be employed by an approved method to protect it from erosion.

I. Seeding may be performed at any time during the Spring, Summer, or early Fall. Notify the Engineer at least 48 hours before sowing seed and must not begin without the approval of the Engineer. When conditions of high winds, excessive moisture or drought are such that satisfactory results are jeopardized, the Contractor shall cease the work.

J. The Contractor shall begin maintenance of the seeded areas immediately after planting and work shall be guaranteed until final acceptance of the work by the Engineer.

K. The Contractor shall repair areas damaged by erosion, wind, drought or other causes. Such areas shall be reseeded and remulched as specified under this work.

L. Seeded areas will be accepted provided all requirements, including maintenance, have been satisfied, and a healthy, uniform, close stand of the specified grass has been established, free of weeds, bare spots and surface irregularities.

END OF SECTION

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